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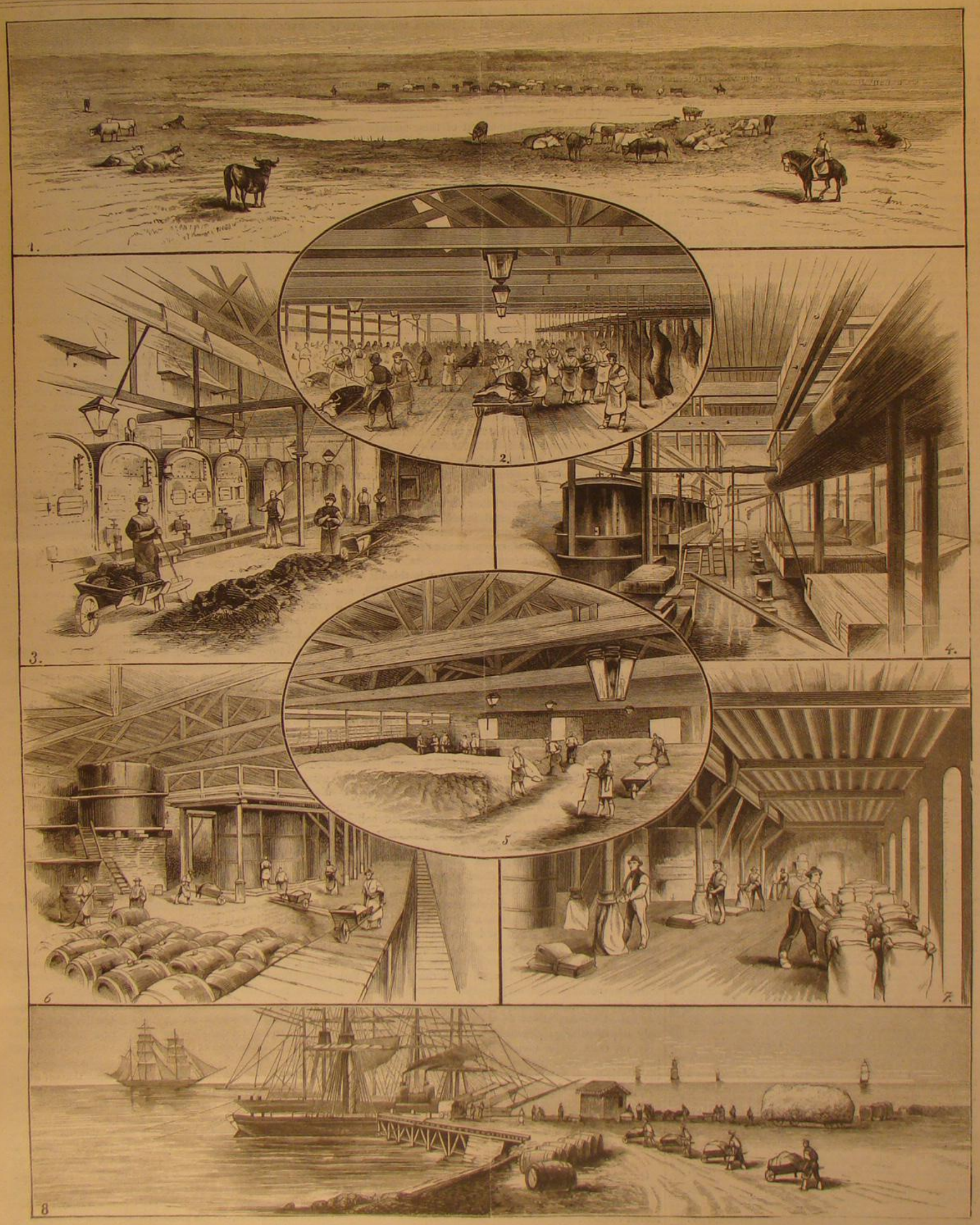


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# Scientific American.

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NEW YORK, SATURDAY, AUGUST 6, 1881.


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THE SCIENTIFIC AMERICAN SUPPLEMENT

**No. 292,**

**For the Week ending August 6, 1881.**

Price 10 cents. For sale by all newsdealers.



## THE INDUSTRIES OF NEW YORK.

That New York is an important manufacturing center, as well as the commercial metropolis of the country, is generally little thought of, yet it is this "productive industry" which has principally caused its astonishing growth in population, and by which the most of those who live here find their support. Its vast commerce requires many workers, and supports a large class who do little or no work, simply living on the interest of former accumulations; but the productive industry here, aside from the mere handling of the products of the industry of others, distributes, through the countless channels which reach the family and the individual, the means of living, which have caused our thoroughfares to be so crowded, and which have necessitated so many miles of street railways, elevated railroads, ferries, and bridges. The total of imports and exports of New York city for the last calendar year was $896,189,814—a little more than half of that of the whole United States—but the productions of the workshops and factories of the city, whereby the raw or half finished materials were brought into shape for practical use, amount to more than one-half the value of the exports and imports.

The statistics showing the extent of these manufacturing industries have recently been forwarded to the Census Bureau at Washington, by Charles E. Hill, who has been the chief special agent here supervising their collection. They include the business of the year from June, 1879, to June, 1880, and do not cover a few special lines of industry, which have only been made subjects of investigation by general agents for the whole United States. For 189 different branches of business, as specified, the capital employed was $157,581,749, in 11,068 establishments, employing 262,459 hands, using 1,312 boilers, and 1,124 engines of 41,951 horse power, and producing goods valued at $435,422,102. Of these hands 133,998 were males above 16, 63,482 females above 15, and 1,393 children and youth, and this enumeration of help does not include proprietors or firm members, superintendents, bookkeepers, or salesmen—none, in short, connected with the mercantile department, but only those working for wages as producers. It will be at once observed that, adding these exceptions, we would greatly swell the number of those who find employment in the several branches of business, although the latter would largely be paid according to the profits of the business. Taking the materials used—$267,043,236—plus the wages paid, from the value of the products, we have $78,864,832, for the payment of these others engaged and the interest on capital. The figures given for capital are, probably, more imperfect than those for any other particular, for in many cases they represent an original investment, largely grown in value, and many of the industries have grown up literally almost without capital, except such as furnished by the brain and muscle of their founders.

Among the important items not included in this list is the manufacture of silk goods (which was $7,842,515), gas ($5,199,979), shipbuilding, and brewing and distilling, with several minor industries, for which the statistics have not yet been completed. The whole, it is estimated, will bring the total very nearly up to $500,000,000.

The most important industry in the list is the manufacture of men's clothing, a branch of business which has grown wonderfully since the introduction of power for cutting as well as sewing. The production in this line is valued at $59,798,697, employing 64,056 hands, while women's clothing figures for $18,599,487, employing 17,267 hands. In boots and shoes, 123 factories make goods to the value of $4,799,371, and 716 custom shoemaking shops produce $2,863,620 worth. The products of slaughtering and meat packing were valued at $29,297,527, including 244,275 beeves, 122,500 calves, and 662,600 sheep. In machinery the product was $5,077,046; and in engines and boilers, $3,213,371; car building and repairing, $547,037; metal goods and metal spinning, $445,473; steam fitting and steam heating, $1,289,259; iron casting and finishing, $5,489,251; tin, copper, and sheet iron ware, $2,347,182; furniture, $9,605,779; wood brackets, moulding, turning, etc., $1,371,083; and drugs and chemicals, $3,138,178.

But any notice of the business and manufacturing industry of New York city would be incomplete without taking into account the circumstances of its location, whereby a population of some 800,000, just across the East and North Rivers, whose shores are fringed with the factories and warehouses of city firms, all contribute to swell the production of this common center. The industries thus carried on are not at all considered in these statistics, which cover only the establishments within the city lines; when, however, the work of the Census Bureau shall be so far completed that it will be possible to collate the figures touching the productive industry of these intimately related sections, the grand total will show an aggregate of exchangeable commodities which will, in money value, bear no mean proportion to the total exports and imports of the port of New York.

## TOY PISTOLS AND LOCKJAW.

On summing up the casualties of our explosive holiday, the Fourth of July, the numbers of the killed and maimed rival those of some battles which have decided the fate of empires.

The majority of the injuries were inflicted by the toy pistol, using blank cartridges, the introduction of which has been followed by a general epidemic of lockjaw, particularly in our larger towns and cities.

The toy is a cheap contrivance of cast iron, with a barrel about two inches long. It is a breech loader, intended for blank cartridges, the powder being held in a metallic case either by a paper wad or by folding inward the slashed end of the cartridge case. There is no half-cock; the trigger catch is roughly made, and there is always danger of an accidental discharge when the hinged barrel is being returned to place after the insertion of the cartridge. At such times the barrel is held in the left hand, and the discharge inflicts an ugly wound in the palm. Other wounds are inflicted by the paper wad, or by fragments of the cut end of the copper cartridge-case, which are shot off with considerable force. In other cases buck-shot, gravel, nails, or other missiles, placed in the barrel by heedless or malicious urchins, have caused severe, sometimes fatal, injuries. The more serious wounds, however, are usually caused by accidental discharges, the powder, wad, or copper fragments entering the lacerated palm, and so injuring the nerves that lockjaw is the result. There were seventeen fatal cases of this sort in Baltimore on the Fourth. Fifty cases were brought in for treatment in three hospitals in this city, with eight or ten deaths; and there is no telling how many cases were under private treatment. Other towns appear to have suffered proportionally except Philadelphia, where, in consequence of fifteen fatalities from toy-pistol wounds last year, the use of the weapon this year was suppressed by the city authorities.

Other towns will do well to follow the example of Philadelphia. Parents are often ignorant or careless, and a five or ten cent pistol offers irresistible attractions to many boys. In anticipation of next year's celebration some means should be adopted to prevent the manufacture, sale, and use of such murderous playthings. Even the use of the pistol-shaped device for snapping paper caps should be stopped. No harm can result from them directly; but the habit which children acquire of pointing such things at each other in fun, is not conducive to care or caution in handling real pistols.

## RELATIVE RISKS OF RAILWAY TRAVEL.

A few weeks ago, when a traveler was murdered on a railway train near London and thrown out of the car while the train was passing through a tunnel, a great ado was made, especially in American papers, with regard to the insecurity of travelers in the English cars. The plan of confining two or three or at most half a dozen travelers in a small cab, out of reach and hearing of their fellow travelers on the train, and unprotected by conductors or other trainmen, was unsparingly criticised and ridiculed. For the sake of a degree of (undesirable) privacy any traveler, it was said, was liable to find himself cooped up with a murderer like Muller or Lefroy; or, in case of a lady, with a brute like Valentine Baker. The opportunity thus afforded for robbery, murder, or outrage was declared to be impossible with American cars, and remarks derogatory to the common sense of Englishmen were freely indulged in because they would not give up their system for ours.

The recent robbery of a train of cars on a Missouri road by a bold and well-organized gang of desperadoes gives the English press an opportunity to retaliate in kind. A prominent London paper says:

"The American cars seem specially made to invite this kind of outrage. With the English system such a wholesale raid is impossible. In any case one carriage alone could be robbed here before the passengers and officials could organize resistance. As there is no example of such an event in our railway history, we may assume that the difficulties and dangers are so great as to deter even the most daring criminals. The actual danger of murder or robbery is far less on English lines than on American."

In this view of the case our English friends are as much at fault as the American critics of the English system were. The conditions under which the two systems are operated make a fair comparison of the relative security to life and property afforded by them quite impossible, while the rarity of violent crimes under both systems shows that the risk to the traveler in either is amazingly small. Indeed, considering the large numbers of persons always in transit by rail, both in this country and England, the rare occurrence of crimes on the road must be accepted as proof either that traveling is exceptionally conducive to morality or else that, whether car compartments are large or small, railway travel affords fewer facilities for the commission of serious crimes than the ordinary conditions of social life. The murder of people in church during divine service is a more frequent occurrence, if criminal statistics are worth anything, than like crimes on railway trains; but that affords no basis for a comparison of car seats and church pews as aids to crime.

It is pretty certain that under ordinary conditions of travel no ill-disposed person would choose a public car on an American railway for individual murder or robbery with any reasonable hope of escape, as Lefroy and Muller did in England. It may be equally true that an organized raid upon a train of cars on an English road would be prevented or made unsuccessful by the plan of the cars and the distribution of the passengers. But such a deterrent effect would be much less certain were the train to be run over a long and sparsely settled route, such as was taken advantage of by the Missouri train robbers. Such crimes are no more attempted in the neighborhood of our larger centers of railway communication then they are on roads leading from London or Liverpool, and it would seem that the surroundings of the roads and the more frequent stations are more influential in pre-

venting train robberies in the East as in England, than anything in the construction of the cars or the make up of the train. Given equal time for the work, we are inclined to think that fewer men would be required to capture and go through a train of English cars than one of American cars, while the robbers' chance of meeting serious resistance on the latter would be much the greater. But this question of comparative immunity from attack plays a very insignificant part in determining the choice of large or small compartments, compared with popular customs, popular habits of thought with respect to privacy or promiscuity, the varying hazard of undesirable social contacts while traveling, and all that sort of thing. The English have their prejudices as Americans have theirs, and matters of this sort are more apt to be decided by prejudice than by the calculation of infinitesimal risks to life or property.

### PATENTS IN TURKEY AND LIBERIA.

General patent laws have been lately passed and promulgated in Turkey and Liberia, in which countries American citizens may now, for the first time, secure their new inventions.

The Turkish patent law is substantially a copy of the French and German systems. Any person may take a patent on deposit of drawings and specifications. Longest term of the patent fifteen years, annual tax $18. The invention must be worked within two years from the date of the patent. The penalties for infringement and the proceedings are the same as in European countries.

In Liberia the patentee must be the inventor, or must have lawfully acquired the invention from the inventor. Drawings and specifications must be furnished. The government fee is fifty dollars. The proceedings are much the same as in taking an American patent. The invention must be worked within three years after the grant of the patent. Those desiring to obtain patents in either of the above countries may obtain further information at this office.

### WATERPROOFING.

Without considering the processes by which cloth is waterproofed with such substances as India-rubber, oils, wax, and varnishes, there are several processes in practical use by which cloth is rendered non-absorbent of water—and for all practical purposes waterproof—without materially affecting its color or appearance, greatly increasing its weight, or rendering it entirely airproof. These processes depend mainly upon the reaction between two or more substances, in consequence of which a substance insoluble in water is deposited in the fibers of the cloth.

The following are several of these processes:

LOWRY'S PROCESS.

| | |
|---|---|
| Soap | 2 ounces. |
| Glue | 4 " |
| Water | 1 gallon. |

Soften the glue in cold water and dissolve it together with the soap in the water by aid of heat and agitation.

The cloth is filled with this solution by boiling it in the liquid for several hours, the time required depending upon the kind of fiber and thickness of the cloth. When properly saturated the excess of liquid is wrung out and the cloth exposed to the air until nearly dry; then digested for from five to twelve hours in the following solution:

| | |
|---|---|
| Alum | 13 ounces. |
| Salt | 15 " |
| Water | 1 gallon. |

It is finally wrung out, rinsed in clean water, and dried at a temperature of about 80° Fah.

Paut's process requires a small quantity of oil, but in other respects resembles the last. It is given as follows:

| | |
|---|---|
| Sodium carbonate (com'l) | 1 pound. |
| Caustic lime | ½ " |
| Water | 2½ pints. |

Boil together, let it stand to settle, then draw off the clear lye, and add to it—

| | |
|---|---|
| Tallow | 1 pound, |
| Resin | ½ " |

previously melted together. Boil and stir occasionally for half an hour, then introduce—

| | |
|---|---|
| Glue (previously softened) | 3 ounces, |
| Linseed oil | 3 " |

and continue the boiling and stirring for another half hour.

In waterproofing one-half ounce of this soap is mixed with a gallon of hot water, and in this the goods are soaked for about twenty-four hours, according to thickness and character. The pieces are then allowed to drain until partly dried, then soaked for six hours or more in a solution prepared as follows:

| | |
|---|---|
| Aluminum sulphate | 1 pound. |
| Lead acetate | ½ " |
| Water | 8 gallons. |

Shake together, allow to settle, and draw off the clear liquid.

Wring out after rinsing, and dry at a temperature of 80° Fah.

Bienvaux uses, instead of glue and oil as above, the gelatinous portion of sea-wrack grass with a small quantity of a drying oil and common resin-soda soap.

In Reimann's process the cloth is passed slowly by machinery through a tank divided into three compartments, the first containing a warm solution of alum, the second a warm solution of lead acetate, and the third pure water, which is constantly renewed. The cloth on passing from the latter is brushed and beaten to remove the salt adhering to the surface, and finally hot pressed and brushed. In this case lead sulphate is deposited in the fibers.

In Townsend's process two solutions are used as follows:

| | |
|---|---|
| British gum | 20 pounds. |
| Soap, white | 10 " |
| Water | 16 gallons. |

The solution is boiled for some minutes, and if color is required one pint of logwood liquor is added. The second solution consists of a saturated solution of alum in water, or—

| | |
|---|---|
| Zinc sulphate | 6 pounds. |
| Water | 9 gallons. |

Bullard's process is somewhat similar to Riemann's. In this strong aqueous solutions of sulphate of aluminum and lead acetate are used alternately.

Berlin waterproof cloth is said to be prepared by saturating the cloth in a solution of acetate of aluminum and copper, then dipping it successively in water glass and resin soap.

### MOTHER-OF-PEARL AND PEARL INLAYING.

Mother-of-pearl is chiefly obtained from the pearl oyster (*Meleagrina margaritifera*) which is found in the Gulf of California, at Panama, Cubagua, Ceylon, Madagascar, Swan River, Manila, and the Society Islands. The black-lipped shells from Manila are most highly prized. The Society Islands furnish the silver-lipped sort, and Panama the "bullock" shells.

The genera *Haliotus*, turbo, etc., also furnish some mother-of-pearl. Technically the mother-of pearl obtained from the pearl oyster is known as white pearl; that of *Haliotus* or sea-ear as aurora or ear-shell; it is easily distinguished from the former by its prismatic colors and wrinkled appearance.

The peculiar and varied tints exhibited by mother-of-pearl is due to the structure of its surface, which, owing to the great multitude of minute grooves upon it—often many thousands to the inch—decompose the light which falls upon it and reflect different hues.

The pearl shell is lamellar in structure, and admits of being split into laminæ, but this method of dividing it is seldom resorted to owing to the liability of spoiling the shell.

In working up mother-of pearl the saw, file, and grindstone are the principal tools employed. A shell is selected with a coating of the substance of a thickness as nearly as possible to suit the required purpose. Square or angular pieces are cut out with a small circular or buck or fret saw to suit convenience, the piece being held and manipulated with the hand or clamped in a vise. Buttons and such circular pieces are cut with an annular or crown saw fixed upon a mandrel. All such tools used in cutting pearl must be kept well moistened with water to prevent over-heating. The pieces are usually dressed upon a grindstone, the edge and face of which are grooved or ridged to prevent clogging. The stone is kept wet when in use; for this purpose weak soapsuds is better than water alone.

When the pieces have been properly shaped on the stone they are dressed with pumice stone and water. In some cases the better plan is to have the piece of pumice stone shaped so as to adapt it to the form required and held in a vise while the work, held in a clamp, is revolved in contact with it on the lathe. After the application of the stone fine powdered pumice stone, free from coarse grit, is applied with a cork or cloth moistened with water. In the final polishing rotten-stone is employed. This is moistened with dilute sulphuric acid (1 acid, 15 water) and applied with a cork. The acid is said to develop finely the striated structure of the shell. In some works it is thought necessary to use emery before the rotten-stone and to use a limpid oil in place of the acid.

Knife and razor handles of pearl, after having been roughed out, are drilled where the rivets are to be inserted, lightly riveted together, shaped on the stone, and finished as above described, the last finishing touch often being done by friction of the hand of the workman.

In some shops much of the polishing is done on cloth-covered wheels, the moist cloth carrying the polishing materials. Separate wheels are used for the different materials. For some common work powdered chalk or Spanish whiting is used in place of rotten-stone.

Pearl is etched by a process very similar to that used in etching copper. The designs or patterns are drawn upon it with asphaltum varnish, and all parts not intended to be etched having been similarly protected, the piece is submitted to the action of nitric acid. When the parts unprotected have been sufficiently eaten away by the acid the piece is rinsed in cold water and the varnish washed off with a little turpentine or benzine.

Thin pieces of mother of pearl of a like pattern are usually gang-cut; that is, the thin plates are glued together, then held in a clamp and cut, drilled, and dressed as one piece, after which they are separated by being thrown into hot water, which separates the glue.

In common pearl-inlaid work, films or very thin pieces of mother of-pearl are connected to a background, usually of *papier mâché* or iron, by japan varnish. The plate having been cleaned and dried receives a coat of the varnish, and when this is nearly dry the pieces of pearl, cut out with a scissors by the artist to represent leaves or designs, are pressed against and adhere to the varnish. The plate is then put in the japanner's oven until the coating becomes hard. A second coating of varnish is then put on—indiscriminately over the pearl and all—and when this has been dried or hardened in the oven the portions adhering to the pearl pieces is removed with a knife blade, and the whole surface is rubbed smooth with pumice stone and water. With the aid of a little gold size, gold leaf, and color, and camel's-hair brush the artist then develops the design, the beauty of which depends of course upon his skill. Finally the article receives a coat of clear spirit varnish.

Besides the white and aurora shell referred to above, the glistening green snail shell is very frequently used. Its tints are light and dark green, yellow, and pink, blended. The varnished surface is sometimes ornamented with transferred drawings or engravings. When the varnish is nearly dry the engraving is spread out face downward upon it and carefully pressed so as to exclude air bubbles. After the varnish is thoroughly dry the paper is well moistened with warm water by means of a sponge. It may then be rubbed off, the lines of the print remaining adhering to the varnish.

### THE PARIS ELECTRICAL EXHIBITION.

Among the promised novelties connected with the exhibition will be a boat propelled by electricity. For this purpose there will be a water basin fifty feet in diameter, in which the boat will be kept moving. In the center of the basin, on a pedestal, will be a brilliant electric light. At various points within the palace models of statues will be placed as supports for electric lights. Each exhibitor of lights is also to have a saloon set apart for the special show of his system.

The passenger station of theelectric railway will be within the exhibition building, and the track will run on the ground—not elevated as at first intended.

During the exhibition there will be a congress of electricians, of which sixty-five French members have been appointed by the President of the Republic. The congress will publish an official report, and only members will be allowed to be present.

### Another Comet Discovered.

Mr. J. M. Schaeberle, of Ann Arbor, Mich., discovered, July 13, a new comet, the third of 1881. In the telescope it showed a bright center and a clear though faint tail. It appeared in the northeast, in the constellation Auriga, not far from the point of appearance of the comet now passing out of sight. The new comet is rapidly increasing in brightness, and will continue to do so until about the 21st of August, when it promises to be quite conspicuous, certainly as a telescopic object. It will be nearest the earth about August 20, a day or two after its perihelion passage, when it will be about 40,000,000 miles away. So far "the orbit presents no special resemblance to that of any known comet," the Harvard astronomers say, though Professor Stone, of Cincinnati, thinks he finds in it a close resemblance to that of the great comet of 1337. It seems to be moving in a northerly direction.

### American Antimony.

A Baltimore dispatch informs us that a carload of antimony, ten tons in all, was on the 14th of July received by C. L. Oudesluys & Co., from the southern part of Utah Territory being the first antimony received in the East from the mines of that section. The antimony was mined about 140 miles from Salt Lake City. The ore is a sulphide, bluish gray in color, and yields from 60 to 65 per cent of antimony. All antimony heretofore came from Great Britain and the island of Borneo, and paid an import duty of 10 per cent ad valorem, and there is also some from Sonora. It is believed that with proper rail facilities to the mines of the West there will be no need of importations.

### Underground Telegraph Line in New York.

The United States Underground Telegraph Company has laid an experimental series of seventy-two wires, extending from the headquarters of the Fire Department, in Mercer street, to Police Headquarters in Mulberry street. The wires are laid in long wooden boxes covered with a preparation of silica and other substances designed to exclude dampness and secure perfect insulation. It is said that if the present experiment is successful the system will be extended so as to include the police stations, engine-houses, and fire-alarm boxes.

### Fired by Electricity.

An interesting illustration of the danger attending the manufacture of some kinds of rubber goods was shown in the origin of the recent fire which occurred in the Ætna Rubber Mills, at Jamaica Plains. The cement which fastens the seams of rubber coats is largely made of naphtha. The mere act of lifting a piece of rubber cloth from a pile of half-a-dozen similar ones, cut for garments, developed so much electricity that a spark was observed to escape. It came in contact with the naphtha cement, or with gases arising from it, and instantly the whole room was in a blaze. Fortunately the fire was extinguished without destroying the mill, the loss being only about a thousand dollars.

It is not known that anything can be done to prevent the occurrence of another accident of precisely the same kind, whenever all the atmospheric conditions are favorable. One would suppose, however, that a certain degree of dampness would remove all danger from that source.—*Commercial Bulletin.*

M. BOUCHUT'S experiments with pepsine for destroying worms in the stomach and bowels have been continued with extremely promising results. Even the tape-worm succumbs to the digestive action of pepsine in large doses, while the more highly organized tissues of the stomach are unaffected.

### Educated Mechanics.

We have received the twelfth annual and thirteenth statistical report of the Cincinnati Board of Trade and Transportation for 1881, which is a nicely printed pamphlet of two hundred pages.

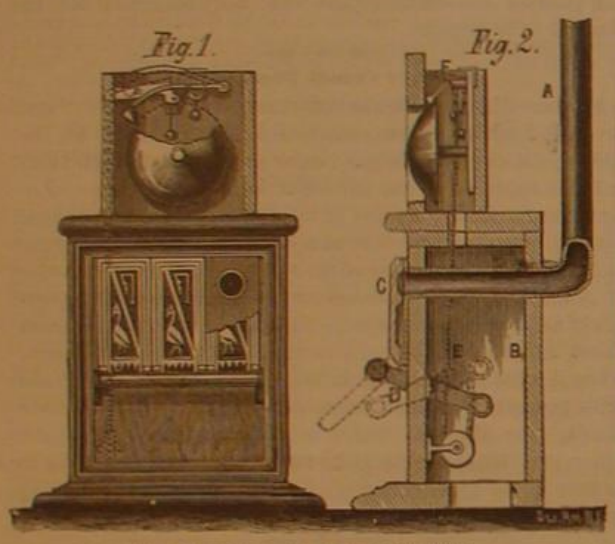
From Article II. of its constitution it appears that the object of this association is to collect and record such local and general statistical information relating to manufactures and commerce as may promote the manufacturing, commercial, and financial welfare of their city, and especially to protect, foster, and develop its manufacturing and other industrial interests.

After commenting on the success, financially and otherwise, of the Eighth Cincinnati Industrial Exposition, the directors, in their report, hint at the establishment of a school of technology, which their position as a manufacturing community makes peculiarly important. They say:

"We need educated mechanics; and no mechanic is a master of his business without the technical training such schools alone can give. The Exposition Buildings furnish ample room and accommodations for such an enterprise, the Mechanics' Institute School is a good nucleus to start on, the Department of Arts and Sciences of the same institution is a step in advance to the end desired, and this year the exposition should be made the means of enlisting a public co-operation which would provide for Cincinnati just such a school as is needed."

### SPEAKING TUBE ANNUNCIATOR.

The engraving shows a novel speaking tube annunciator, in elevation and in section. The tube, A, enters the box,




SPEAKING TUBE ANNUNCIATOR.

B, and terminates behind the hinged drop, C. There may be several tubes and as many drops. Below the drop or series of drops there is a rocker, D, whose arms extend into the box, and are connected by a cord, E, with the trigger of the bell at the top of the box.

When a person in a distant portion of a building wishes to communicate with another who is within hearing distance of the bell he blows in the speaking tube, and the air current thus created being directed against the drop, C, at the other end of such tube, causes it to fall upon the outer bar of the rocker, D. The drop being constructed of a thick metal plate, and therefore heavy, tilts the rocker, as shown in dotted lines, so that it pulls on the cord, E, which, in turn, tilts the lever that raises the hammer, which is instantly released and allowed to fall upon the bell, which gives the required notice. The person thus called will, after respond ing to the message, close or replace the weighted drop in its upright position, and thus relieve the rocker, which, being released, returns automatically to its former position, and is ready for the next alarm.

This invention was recently patented by Mr. W. R. Ostrander, of New York city.

### MOLES—HOW THEY AID AGRICULTURE—HOW THEY CAN BECOME A NUISANCE—HOW THEY MAY BE DESTROYED.

The common ground mole or "meadow mole," as this little animal is often called, is of interest from a zoological point of view, but in this article it is proposed to deal only with the practical side of the subject in its relations to agriculture and horticulture.

The mole is both useful and hurtful. When his services more than counterbalance the injury he commits he should be left unmolested. On the other hand, when he becomes, as he often does, an intolerable nuisance, he may be more or less successfully dealt with in the manner we will proceed to describe.

It is very annoying to see a handsome lawn covered with unsightly ridges plowed by the noses and paws of these little depredators; but the knowledge that they are the natural enemies of the numerous worms and grubs that sometimes make fearful war upon the tender roots of growing young crops, renders it often difficult to decide whether the moles are to be welcomed as allies or combated with such means as are available.

The mole is a purely carnivorous animal, and never does any damage to plant life except in pursuit of his prey. He may break and disturb the tender roots of young plants, but he does not devour them, and he is often wrongly blamed for injury which has been committed by the insect depredators he has caught and devoured.

The field mouse, on the contrary, does devour tender succulent roots, and the mole is too often charged with the damage thus sustained by farmers, in addition to that really due to his burrowings.

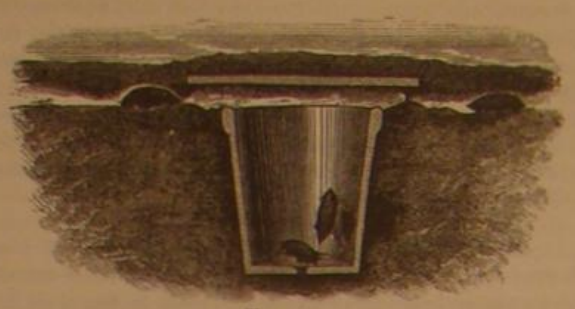


FIG. 1.

Experiments performed in France to determine the usefulness of moles as insecticides show that the number of grubs, etc., destroyed by them is enormous. A single mole, in one instance, devoured 432 maggots and 250 grubs in four days. Another ate 872 maggots and 540 grubs in twelve days.

Prof. Weber, a distinguished naturalist of Zurich, Switzerland, performed some interesting experiments with moles to prove their carnivorous character and their destructiveness to larvæ. In the stomachs of fifteen moles captured in different localities, not the slightest trace of vegetable matter could be found. He shut up two moles in a box in which fresh grass was growing, and also inclosed in the same box a case of grubs and earthworms. The moles devoured 341 white worms or grubs, 193 earth worms, 25 caterpillars, and a mouse—bones, skin, and all—in nine days. He next gave them raw meat cut in small pieces, and mixed with chopped vegetables. The moles ate the meat but did not touch the vegetables; and when vegetables alone were given them the animals soon died of starvation. It has been computed that a single mole may destroy 20,000 grubs in a single year.

In the face of these experiments it is positively asserted by some that moles will eat wheat grains with avidity, and that poisoned wheat introduced into their burrows through holes punched with a stick is sure death to them. We have tried the latter without impairing the health of the moles, and we have more faith in mole traps, in the use of which we have had considerable experience and with varying results.

We give herewith engravings illustrating two implements of destruction, both quite simple, either of which will be found practically useful.

The simplest form of trap, and one that will prove effectual if skillfully employed, is the jar mole trap shown in Fig. 1. A glass or stoneware jar is sunk into the ground under the runs, as indicated in the engraving. The moles, while running along, fall into the jar, and the vertical slip-

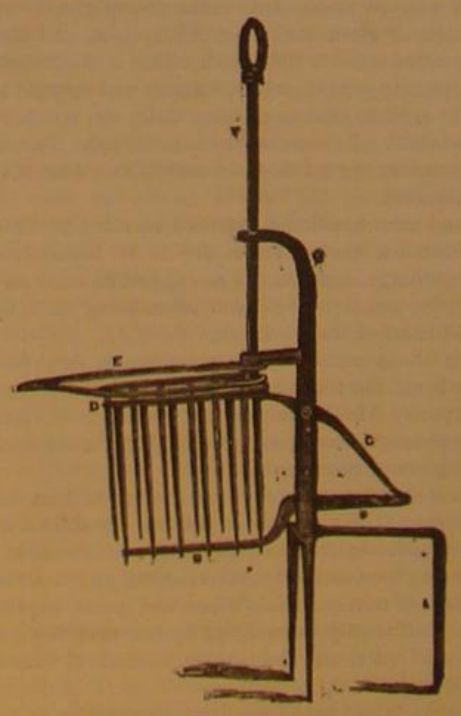



FIG. 2.

pery sides of the jar prevent their getting out again. Field mice are also frequently caught in these traps, which leads to the suspicion that they are the authors of much of the mischief attributed to moles, whose burrows form convenient avenues for the intruders.

Another effective mole trap was described and illustrated in the *Rural New Yorker* some time ago, and not unlike one illustrated in these columns a few numbers back. It is shown in Fig. 2 and is thus described by our contemporary:

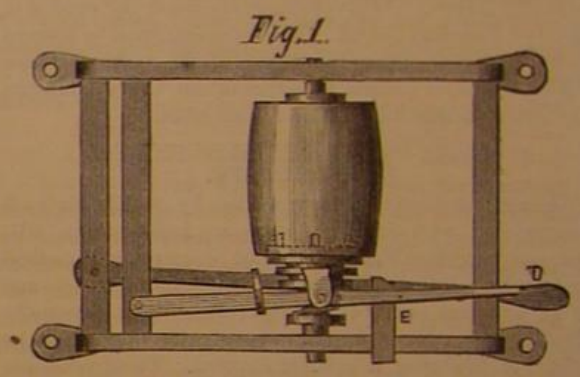
The spikes, A, three-quarters of an inch wide and tapering somewhat at the end, are pressed into the ground beside the mole track as far as possible, so that the trigger, B, which is not yet attached to the lever, C, rests upon the surface of the mole track, the prong head, D, meantime being held in its present position by the ring at the top of the upright square bar, F. Now let it slip from the hand. The force of the spring, E, will drive the prongs, D, into the ground, perhaps half way. Press them entirely down with the foot, and raise and lower them several times so as to give firmness to the earth and a free passage to the prongs. Then raise up the prong head to its present position, and place the lever, C, in one of the notches of the trigger, B, according as the other end of the latter is more or less depressed. Now the mole cannot again pass through this track without so pressing upon the earth as to move the trigger, at B, which releases the lever, C, and permits the spring, E, to act, sending the prong head into its place with great force, securely pinning (generally killing) the mole.

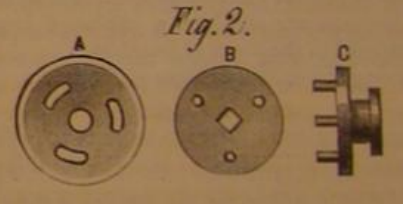
There are a number of other traps more or less effective, but the two represented in our illustrations exhibit the two diverse ways for catching moles, other appliances in use being simply modifications of the plans represented.

### NEW SAFETY PULLEY.

The engraving represents an improved safety pulley applicable to cotton gins and other machinery, when it is desirable to be able to quickly arrest the motion of the machinery in case of accident. The device is very simple and not liable to accidental derangement. Fig. 1 in the engraving is a plan view of the device, and Fig. 2 shows the principal parts.

The pulley is loose on the shaft, and has attached to one end a slotted plate, A, near which the collar, B, is secured on the shaft. A collar, C, carries three pins, which fit corre-




McCORD'S SAFETY PULLEY.

sponding holes in the collar, B, and engage the slotted collar, A, attached to the end of the pulley. The pins projecting from collar, C, are kept into engagement with the collar, A, by a spiral spring surrounding the shaft and pressing against the collar, C. The latter is provided with a grooved boss, which receives a forked arm attached to the lever, E, and the lever, E, is connected with a foot lever, D, so that when either lever is moved the pulley will be instantly disengaged from all connection with the shaft by the withdrawal of the pins from the slotted plate in the end of the pulley.

This device may be made double so that it may be made to shift from one pulley to another, and so reverse the machinery with which it is connected. It may be applied in this way to hoisting machines.

Further information in regard to this invention may be obtained by addressing Messrs. C. C. P. McCord and C. D. Churchell, of Hazel Grove, Independence County, Ark.

### A Conductor's Printing Office.

It appears that German railway conductors are made happy by the addition to their equipment of a paper mill and printing office, the invention of a Berlin engineer, to be hung around the neck, which, according to an exchange, is to completely manufacture passenger tickets before the eyes of the wondering public. The apparatus is said to be somewhat complicated in construction, but its manipulation is as simple as its working is correct, for, should the operator not proceed in the way required by the mechanism, it will not print all the figures and words wanted, but the word "Falsch" (wrong) in the place where the fault was committed. At the same time this portable printer checks the number of tickets issued, so that any given moment the money in the hands of the conductor can be compared with the value of the tickets printed and taken.

### Nervous Headache.

Dr. Œhlschläger, of Danzig, says, in *Allgemeine Medicinische Central Zeitung*, that he has found salicylate of sodium to be a remedy of great value in the treatment of nervous headache, especially if given in a dose of one gramme (gr. xv.) in the beginning of an attack. It usually produces drowsiness, and after a few hours the patient wakes up refreshed and free from pain. It, however, often fails to produce this effect in cases dependent on anæmia.

## THE ANTECEDENTS OF THE BELL TELEPHONE.

BY GEO. M. HOPKINS.

Should the recent decision of the U. S. Circuit Court, at Boston, in reference to the Bell telephone patent, be sustained by the higher court, it will prove calamitous not only to inventors who have succeeded Bell in telephonic inventions, but to the public at large, who will be at the mercy of a powerful monopoly, so far as telephonic communication is concerned. Already the workings of this power are beginning to manifest themselves in increased and apparently exorbitant rents, with no corresponding increase in the efficiency of the instrument or in the perfection of the service.

This being the condition of things, it behooves telephone inventors and telephone users to inquire as to the scope of Bell's patent, and to acquire a knowledge of the status of the art of telephony prior to the invention of Bell.

Should it be found that articulate speech had been transmitted from one point to another by means of electricity before Bell thought of the telephone, or should it be proved that instruments as old as the telegraph, without any alterations or additions whatever, could be made to transmit and receive articulate speech through the agency of electricity, then it might be very properly questioned whether the broad claim for the "new art of transmitting speech by electricity" could be sustained, even though Bell's results were secured by improved devices.

In regard to the early transmission of speech, it is certain that Reis, in 1861, transmitted vocal sounds by means of electricity, and it is authoritatively stated that he transmitted words.* It is certain that Reis's instrument *can* be used to transmit articulate speech; but now this instrument is claimed to be crude and imperfect. The ordinary Western Union telegraph key and sounder, as elements of a telephonic system, are even more crude and imperfect, and yet with a common telegraph key, used as a transmitter, I have transmitted articulate speech, which has been received by means of a common telegraph sounder, and this without modifying either key or sounder in the least. It is simply a matter of adjustment. Now, could a broad claim for talking to a telegraph key and listening to a telegraph sounder be sustained? Can a broad claim for a "*new* art of transmitting speech by electricity," by old and well known instrumentalities, be sustained, when the new results are secured by mechanical skill, exercised in adjustment merely?

Clearly, if Reis transmitted vocal sounds, or signals, or words, and if Bell has done the same thing through the agency of the same force, but in a more perfect manner, it should signify nothing, since degrees of perfection are not patentable. As a writer of this journal very aptly said a short time since: "If Reis's instrument was crude and imperfect, the same may be said of Bell's, for when it is constructed and operated according to his patent, and used independently of subsequent inventions, it proves inadequate for commercial purposes under the usual conditions of use." The original principle of the Bell telephone has really been replaced by Reis's invention, as will presently appear. That is, the Bell telephone has reached its present usefulness and popularity through the adoption of the Blake or some other form of transmitter substantially like the original Reis transmitter.

It is claimed by the advocates of the Bell system of telephony that the lack of efficiency in the Reis transmitter was due to the fact that intermittent currents of electricity were employed instead of an "undulatory" current, which Bell holds as essential; but it can be proved that in all contact telephone instruments the current is intermittent, and this is especially noticeable in the class having small contact surfaces like the Blake and Reis instruments.

* *Boettger's Notizblatt*, No. 15; *Dingler's Polytechnic Journal*, vol. 169, p. 369, 1863.

If the language of the learned judge who rendered the decision above referred to is applicable to Bell's invention, it should also apply to that of Morse or Reis. The judge says: "There is some evidence that Bell's experiments with the instrument described in Fig. 7, before he took out his patent, were not entirely successful; *but this is now immaterial; for it is proved that the instrument will do the work, whether the inventor knew it or not, and in the mode pointed out by the specification.*"

It is equally just to say that the telegraph key and sounder are operative for the transmission of speech, "and that it is immaterial whether Morse and other telegraph inventors knew it or not, "*for it is proved that the instrument will do the work*," and as the invention of the telegraph now belongs to the public, every function of the telegraph instrument belongs to the public also.

It is even more just to say the same of Reis's invention. It makes no difference whether Reis knew it or not (but he did know it), the transmission of articulate speech by means of his instrument is an undeniable fact.

From the foregoing it will be seen that it is at least questionable whether *any one* is now entitled to a broad claim for transmitting speech by electricity.

Many of the claims of Bell as to the particular method and means employed by him for the transmission of telegraphic and other signals are manifestly too broad and cover some of the oldest inventions in telegraphy.

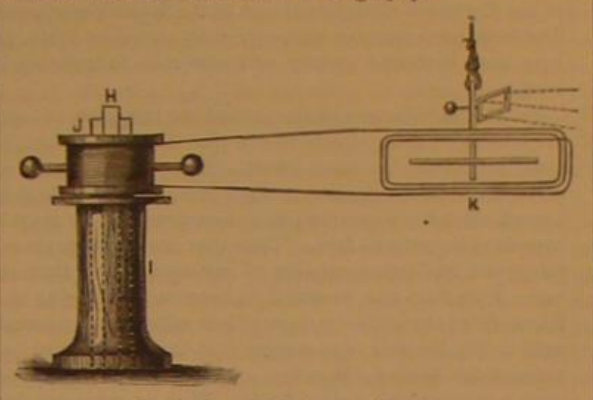



Fig. 2.—Oersted's Induction Apparatus.

For example, the first and second claims in his patent of March 7, 1876, read thus:

"1. A system of telegraphy in which the receiver is set in vibration by the employment of undulatory currents of electricity.

"2. The combination of a permanent magnet or other body capable of inductive action with a closed circuit," etc.

These claims are anticipated by the invention of Oersted in 1820 (Fig. 2). His apparatus consisted of a compound bar-magnet, H, mounted in a standard, I, and surrounded near its upper end with a coil, J. This coil was in a closed circuit with a distant coil, K, containing a vibratory magnetic needle. By moving the coil, J, up and down on the magnet, H, "undulatory" currents were produced, which vibrated the needle, giving intelligible telegraphic signals.

The more recent magneto-induction key of Siemens and Halske (Fig. 3) operates in substantially the same way.

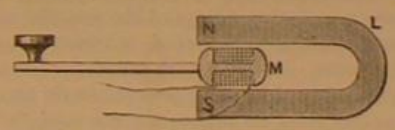



Fig. 3.—Siemens and Halske's Magneto-Induction Key.

Between the poles of the magnet, L, is placed a Siemens armature, M, which, being vibrated by means of the lever, produces "undulatory" currents in the circuit in which it is included. This system antedates Bell's.

The first Bell telephone is shown in Fig. 4. The armature *c* is fastened loosely by one extremity to the uncovered leg of the electro-magnet *b*, and its other extremity is attached

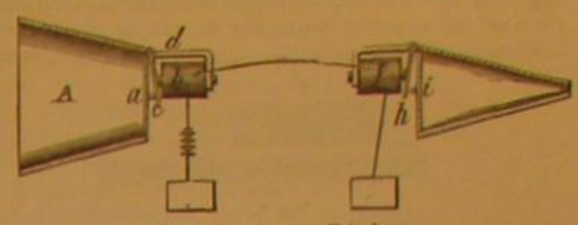



Fig. 4.—Bell's First Telephone.

to the center of a stretched membrane *a*. When a sound is uttered in the larger cone *A* the membrane attached to it is set in vibration, and the armature connected with the membrane is forced to partake of the motion, and thus electrical undulations are created upon the circuit which influences the electro-magnet *f* at the opposite end of the line, so that the motions of the armature *h* and membrane *i* are the same as in the same members of the transmitting instrument.

Fig. 5 represents the later Bell telephone. The form is

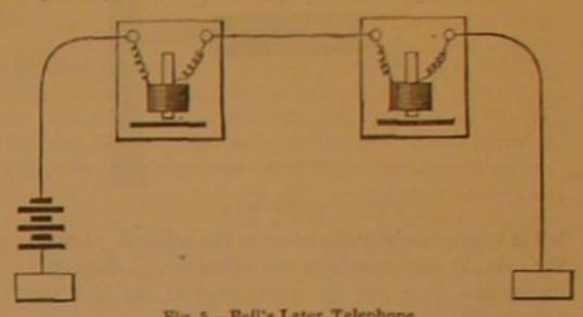


Fig. 5.—Bell's Later Telephone.

simplified, but the principle upon which it operates is the same as that of the first instrument.

It will be observed that the transmitter and receiver are alike, that the instruments are upon a continuously closed circuit, and it seems to be questionable whether Bell's invention covers more than this specific arrangement.

But this arrangement is not the one so largely employed at present by our telephone exchanges. The instruments used at opposite ends of the telephone wires are incapable of being used interchangeably as transmitter and receiver. In the present system of telephony an instrument similar to that shown in Figs. 4 and 5 is used as a receiver, but employed in this way it is difficult to see how it differs materially from Reis's receiver, invented, used, and published twenty years ago.

The Reis receiver, shown in Fig. 6, is familiar to all

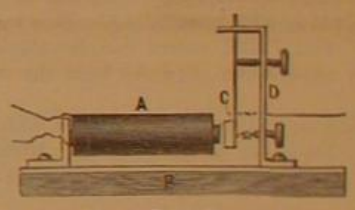



Fig. 6.—Reis's Receiver.

students of telephony, but the lack of patentable difference between it and the Bell instrument may not be apparent at first. In this instrument there are all of the essential elements of the Bell telephone—the magnet, the sounding board or diaphragm, and the armature, "capable of inductive action"—and while it can be used in its original form, as shown in Fig. 6, it may be simplified, whereupon the identical character of the instruments of Bell and Reis will at once appear.

The original Reis instrument (Fig. 6) consisted of an electro-

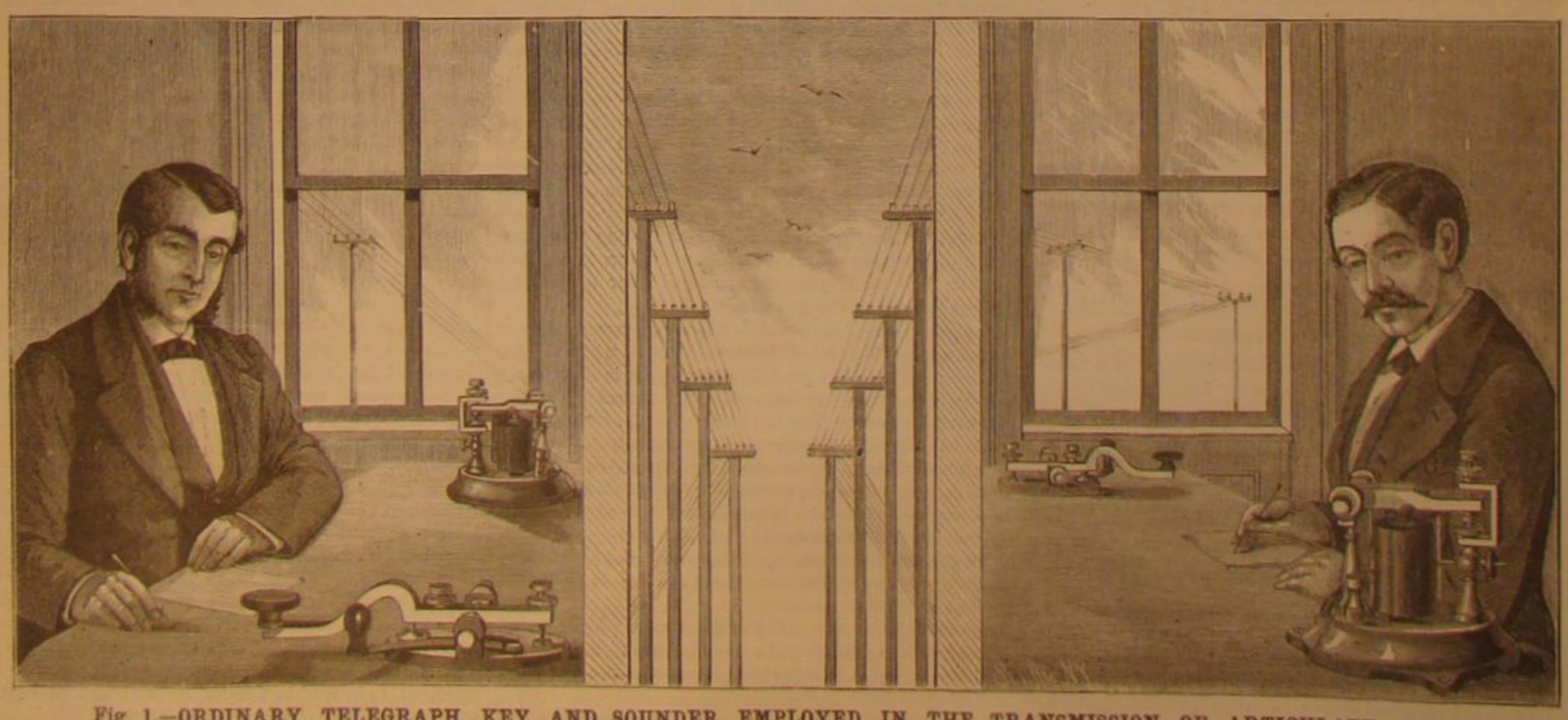


Fig 1.—ORDINARY TELEGRAPH KEY AND SOUNDER EMPLOYED IN THE TRANSMISSION OF ARTICULATE SPEECH.

magnet, A, mounted on a sounding board or diaphragm, B, and was provided with an armature, C, sustained by an arm, D, attached to the diaphragm. By dispensing with the adjusting screws and spring support of the armature (cutting them off on the dotted line in Fig. 6), and by attaching the armature directly to the angled arm, D, as in Fig. 7, an ope

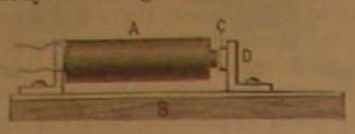



Fig. 7.

rative instrument is formed, which, although simpler than the original instrument, possesses no patentable features.

By straightening the angled arm, D, so that the diaphragm may be placed directly in front of the poles of the magnet, as in Fig. 8, the form of the instrument is further changed,

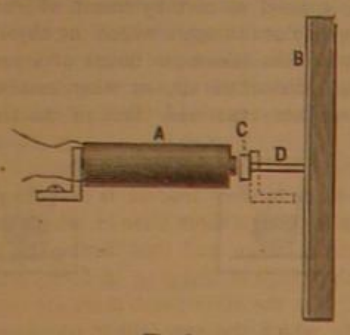



Fig. 8.

but it is substantially the same as the original. Leaving out the arm, D, and attaching the armature, C, directly to the diaphragm, B, is not an invention, and the instrument is still the Reis receiver.

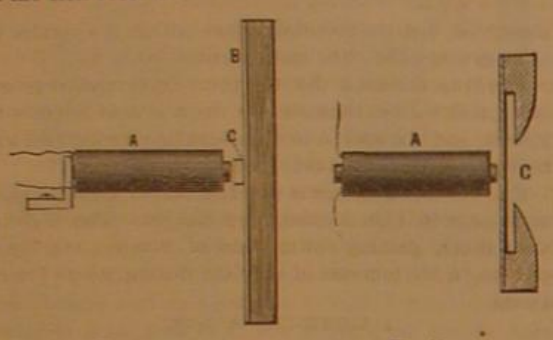



Fig. 9. Fig. 10.

Suppose the armature, C, to be flattened or rolled out so as to be capable of replacing the diaphragm, B, the instrument would then appear with but two of the original elements (Fig 10) viz.: the magnet, A, and the armature-diaphragm, C: it is still essentially the Reis receiver. Is it supposable that a valid patent can be obtained by omitting a few non-essential elements from the original instrument?

Reis's receiver was used in connection with a transmitter of his own invention, which was totally different from his receiver. The transmitter (Fig. 11) consisted of a box pro-

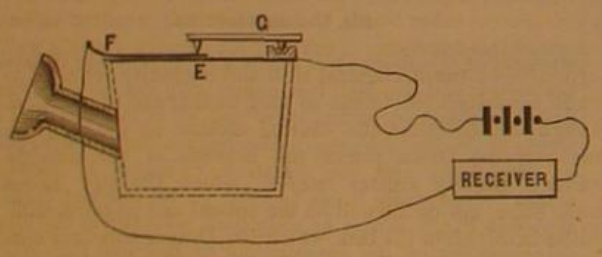



Fig. 11.—Reis's Transmitter.

vided with a mouthpiece, and covered by a membrane, E, carrying a platinum contact surface, F, which is touched lightly by a platinum point carried by the arm, G, one end of the latter resting in the mercury cup to make a perfect yet frictionless electrical connection. The platinum, F, and arm, G, are in the circuit with the battery and receiver, and the interruptions of the current take place between the platinum point on the arm, G, and the platinum, F, carried by the diaphragm.

Fig. 12 shows the essential members of the Blake trans-

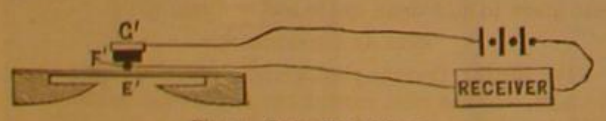



Fig. 12.—Blake Transmitter.

mitter, which is now used almost exclusively. It is hardly necessary to point out the similarity between this instrument and the one just described. The diaphragm, E', platinum contact, F', and spring arm, G', are substantially the same as the elements E, F, and G of the Reis instrument, the only difference being the substitution of a piece of carbon in the end of the arm, G', for the platinum in the end of the arm, G.

From what has been said it will be seen that the system of telephonic communication in use to-day is more Reis's than Bell's.

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AN Agricultural and Industrial Exhibition is to open on the 14th of September, 1881, at the exhibition grounds, Mile-End, Montreal. The prize list fills a pamphlet of 200 pages. Twenty-five thousand dollars in prizes are to be distributed to exhibitors. It closes on the 23d of the same month.

## LIEBIG'S EXTRACT OF MEAT.

Baron von Liebig, Germany's great chemist, ascertained that the soluble constituents of 34 pounds of pure muscle meat (equal to 45 pounds of ordinary meat as it is received from the butcher) may be concentrated by boiling to 1 pound of extract, sufficient for the preparation of 190 parts of bouillon. With his keen perception he foresaw that the manufacture of this extract might become a great industry. He conceived the idea that the transmarine countries rich in cattle might become tributary to the necessities of Europe.

In the year 1850, at the beginning of the manufacture, the Royal Apothecary at Munich consumed scarcely one hundredweight annually, that is, one-tenth part of an ox, and Liebig himself did not imagine that in a score of years the number of cattle falling victims to this industry would number millions. This statement will not appear exaggerated when it is considered that in the summer season there are led daily to the slaughtering bench from one thousand to twelve hundred oxen.

The manufactory of Liebig's Extract of Meat Company lies on the eastern (left) shore of the Uruguay River in that state, and is as important to Fray Bentos as Krupp's great steel manufactory is to Essen.

Proceeding systematically, we should consider first the immense pasturing lands upon which the cattle peacefully graze. These cattle are children of the Pampas, descendants of the European cattle introduced by the Spanish conquerors. The large level pastures were especially suited to them, and here they increased greatly and now rove in innumerable herds.

For the manufacture of the extract the best pieces of meat are selected, for the simple reason that these pieces are the most profitable for the extract. When the animals are driven in from the Pampas to Fray Bentos they are kept for a week upon the pasturing places mentioned, where they are permitted to rest and feed. Then they are driven to the corrals, great inclosures capable of containing five thousand oxen; from here men mounted on horseback, swinging their lassos, drive the cattle by degrees into other smaller corrals, until finally the way is so narrow that the animals can only proceed one behind the other. A man stands at the side upon a staging with a short knife. With unerring certainty he strikes the animal close behind the horns into the spinal marrow. As if struck by lightning the animal falls dead upon a platform which rests upon wheels. The body rolls upon a track to the slaughter house, where with almost incredible celerity it is skinned and cut in pieces by skilled and practiced men. In less than seven minutes a whole ox is cut up. In the slaughtering season over five hundred men are employed, powerful fellows, who are very good hearted and harmless characters in spite of their bloody occupation, and notwithstanding the fact that their nourishment consists almost exclusively of meat. The dexterity with which they handle the knife excites astonishment. The meat is separated from the bones, as if the knife were guided through soft butter. One hundred and fifty to two hundred oxen can be handled in this way per hour.

The greatest cleanliness prevails. A plentiful supply of water is obtained from the river for washing. The slaughter house is roofed with iron and glass, and a railway connects it with the principal buildings of the establishment.

The raw material is conveyed in various ways from the slaughter house. The hides are salted, the horns stored, and the tongues are cooked and preserved in tin cans. The best pieces, as free from fat as possible, are used for the manufacture of the extract, while the inferior pieces are made into *tasajo* (meat salted and then dried in the air), which is a favorite article of food for the black population of Brazil and the West Indies. The fatty parts furnish material for the large tallow buying houses. The refuse and offal are dried and made into fertilizers.

The meat for the manufacture of the concentrated extract is freed from fat and gelatine, and passes through the following processes:

First it passes through four cutting machines, which discharge it into nine large wrought iron tubs, each one holding five thousand kilogrammes. In these the meat with an equal weight of water is heated to boiling. Then the liquid passes through pipes into an apparatus invented by Prof. Max Pettenkofer, where it is clarified and separated from the fatty part. Air pumps carry the remaining fluid mass into two reservoirs placed seven meters higher, from which it passes into the evaporating apparatus after it has gone through several straining processes.

The evaporating is effected in five large reservoirs, each having a hundred disks of the same material, which revolve in the liquid; then the extract remains quiet in other reservoirs until the next morning, when it is placed in two cast iron kettles surrounded by hot water jackets, each containing 10,000 liters of the extract, where it is reduced to a uniform mass. Then samples are taken which are subjected to the careful tests of the chemist of the establishment. If these turn out to be perfectly satisfactory as to purity, aroma, and consistency, the extract is packed in tin chests, each containing one hundred pounds, and sent to Europe. Packing the extract in small stone jars for the retail trade is done at the general depot in Antwerp.

The cooked meat remaining in the kettle is dried in the air, and with the addition of a few nutritive salts, and afterward being ground, is manufactured into the so-called meat-food meal.

Connected with the establishment are tin, locksmith, and joiner shops, a foundry, pump works, steam cranes, etc. The company import coal from England at a great cost, from 7,000 to 8,000 tons being consumed yearly.

Four thousand tons of salt are consumed yearly for salting the hides and tasajo.

The cattle slaughtered for the extract are at least four years old, as younger animals will not supply a strong extract.

It is unnecessary to speak of the great value and extensive use of the extract, as it is everywhere acknowledged to be a standard article.

## ENGINEERING INVENTIONS.

An improved car axle box has been patented by Mr. William H. Taylor, of Richmond, Va. The object of this invention is to prevent journals of car axles from heating, and thus avoid the risk of danger and injury resulting from hot boxes on railroad trains. For this purpose the inventor provides for retaining water in contact with the box on one or more sides to dissipate the heat arising from friction.

An improved elevated railway has been patented by Mr. John G. Curtis, of Ludlow, Pa. The invention is more particularly intended for use inside of a building, to convey goods from one part of the building to another, and it may also be used for conveying goods from one building to another, or from place to place in a tannery or other extensive establishments. It consists in a novel construction, arrangement, and combination of an elevated rail or track, a two-wheeled truck, and a car or platform suspended from the truck.

Messrs. James F. Guild, of Dundee, County of Forfar, Scotland, and Arthur E. Knights, of New York city, have patented an improved steam steering apparatus. The objects of this invention are to move a vessel's rudder easily, quickly, and with perfect regularity, to have it completely under control and almost silent in its action, thus in a great measure overcoming objections to the usual steam steering apparatus, especially on passenger steamers; also to provide for steering vessels either by hand or power; to provide for the relief of the operative mechanism from the injurious effects of shocks by strokes of waves against the rudder, and to reduce the power usually required in apparatus of this character.

Messrs. John H. Reynolds, of Emerson, Iowa, Elisha P. Reynolds, of Rock Island, Ill., and Ben Reynolds, of La Mine, Mo., have patented an improved self-dumping trap which automatically discharges its load of earth or other material into any receptacle below its dumping platforms on the release of griping irons by the operation of a conveniently placed hand lever. The invention consists in supporting one or more pivoted dumping platforms, in an elevated framework, said framework supporting the upper end of "ramps" or inclined approaches thereto, whereon teams drawing loaded vehicles may ascend to the platforms to deposit their load of earth or other material thereon and descend therefrom.

An improved baling press has been patented by John Brown, of Memphis, Tenn. The object of this invention is to improve the construction of the baling presses for which letters patent No. 220,216 were granted to the same inventor October 7, 1879, to adapt them to be operated by steam power, and to make them more convenient in use.

## The Presidential Cold Air Machine.

The apparatus which proved most satisfactory in cooling the chamber of the wounded President was furnished by a Mr. Jennings, of Baltimore. It was devised for use in a new process of refining lard. According to the inventor's description the apparatus consists of a cast iron chamber, about ten feet long and three wide and three high, filled with vertical iron frames covered with cotton terry or Turkish toweling. These screens are placed half an inch apart, and represent some three thousand feet of cooling surface. Immediately over these vertical screens is placed a coil of inch iron pipe, the lower side of which is filled with fine perforations. Into a galvanized iron tank, holding 100 gallons of water, is put finely granulated or shaved ice (and salt when a low temperature is required). This water is sprayed upon the sheets in the lower tank constantly. In each end of the iron chamber are openings thirteen inches square. To the outer end of this chamber is a pipe connecting with an outdoor air conductor. To the opposite end is connected a similar pipe leading into an ice chamber at its top, and from the bottom of the same a pipe leads to a small exhaust fan, and from the fan the now cold and dry air is forced direct into the President's room through a flue some twenty feet it length. Air at 99 degrees temperature to day is supplied at the rate of 22,000 cubic feet per hour at the register in the President's room at 54 degrees, and with the windows and doors open the temperature at the President's bed (twenty-five feet away) is maintained steadily at 75 degrees day and night. When the cold air machine was introduced it was intended to keep the windows and doors closed, and under these conditions the machine would create and maintain a temperature of 60 degrees in the hottest weather without using the auxiliary ice-air chamber now used, which was the suggestion of Professor Newcomb and Major Powell, to meet the requirements of cooling the room with the doors and windows open. The closing of them gave the room an air of gloom. An extra ice chamber fan and engine has been put up in a room opening into the hall near the first apparatus, to be used in case of accident and to cool the corridors of rooms adjoining the President's.

### STEAM BOILER NOTES.

The reports of the chief engineers of the English boiler insurance companies of Manchester have been published and contain much useful information for steam users. Mr. McDougall, of the Boiler Insurance and Steam Power Company, claims to have made 13,071 thorough internal examinations and hydraulic tests, and to have had not one explosion and but one serious collapse among the 20,000 boilers in his care. The passage of the Employers' Liability Act, he thinks, will greatly extend the operations of boiler insurance companies, and should tend to effect a great improvement. Mr. Lavington E. Fletcher, chief engineer of the Manchester Steam Users' Association, in his monthly report, states that 971 boilers were examined from May 28 to June 24, of which 467 were thorough annual inspections.

The discussion of the subject of flat cast iron boiler heads is still going on in Philadelphia, and the interest seems to increase. The *Iron Age*, possibly speaking by authority, repeats the assertion that "the Hartford Company have instructed their agents in Philadelphia not to approve boilers with flat cast iron heads with a greater diameter than 36 inches;" but says, "the company do not wish this action to be construed as indicating a desire not to accommodate manufacturers; but in view of the recent verdict of the coroner's jury, in the case of the explosion at the dye works of Gaffney & Dolan, they do not care to continue writing on this class of boilers."

Since the experimental bursting of a duplicate of the Gaffney boiler head by the makers, Sidebotham & Powell, on the 13th of July, as suggested in our "Notes" of July 2, to the jury, and illustrated in the SCIENTIFIC AMERICAN of July 30, the inspectors of Philadelphia seem to have plucked up courage, especially the city inspector, Mr. Overn, who has been prompted by a lawyer, the city solicitor, to stand on his dignity as a mechanical expert, and he accordingly appears, by the *Ledger*, to say that he regarded the test as a satisfactory test as to the strength of cast iron in the ends of the boiler." The cast iron held good up to 450 pounds, and under this showing he (Overn) would have no hesitation in giving a boiler, with the same quality of cast iron, a pressure of 80 pounds to the square inch."

It is due to this gentleman to say that this is perfectly in accordance with his faith before the Gaffney explosion, but a misinterpretation of the cause of that accident by some experts shook his faith in his own judgment.

Some instances of apparent hardship to owners of steam boilers since the flat head controvery began are given in the *Philadelphia Record* of the 16th of July. The lumber mills of Van Horn & Son, at Whitehall, have been closed since the 11th inst., and are likely to remain so, waiting a city inspector's certificate. The machinery of this firm had been running night and day to fill orders, and the loss, besides the cost of new boilers, is represented as being heavy. Cause, 36 inch flat cast iron heads in their 42 foot boilers. Borie & Mackay, Frankford, have received similar treatment from one set of inspectors, while the other passed them so they could continue work. A large number of other boilers have lately been refused certificates, and when this is done by the city inspector they must stop. Messrs. Garsed & Co., large manufacturers of cotton yarns, in Frankford, were compelled to throw out four boilers 80 feet long, while 40 feet of the furnace end of them that were removed fourteen years ago are said to be running now under inspection. It may be urged by the inspectors that these 80-foot boilers are dangerously long, but they have an exceptionally good arrangement of supports, which has served for over thirty years to prevent undue strains from sagging. They rest at the ends upon solid supports. Two sets of four volute steel car springs are placed upon heavy arched girders, at S S, that span the boiler settings at such intervals as to make even and elastic supports, thereby preventing undue strains on the lower side of the boiler from slender proportions.

These four boilers were built by Brooks and Stanhope, in 1850, John Powell (now of Sidebotham & Powell) foreman, and for many years after they were put to work the engineer used leaden gaskets for the man-hole joints, and he had a habit of adjusting his plate and gasket when closing the boilers and screwing up pretty hard. But if the joint was not tight after raising steam, he was accustomed to beat the head with a heavy sledge near the gasket seat, to settle the uneven plate upon the lead and make it steam-tight. The marks of this violence are still plainly seen on the castings, which are about the same thickness and style as the Gaffney boiler heads.

The *Ledger* also credits Mr. Overn with the remark "that he was inclined to believe, from what he had recently observed, that eventually the city would have the entire work of inspection, for he thought the Hartford people would drop the inspection department of their business and confine themselves solely to insurance, relying on the city's inspection."

It naturally occurs to lookers on who feel an interest in the subject to inquire why the verdict of an unfriendly jury should make a breach between an insurance company who have heretofore been not only willing but desirous of insuring, and the friendly manufacturers who were willing and desirous of having them insure boilers that have during their experience proved as safe as any of that type. The Philadelphia *Record*, in commenting on the flat head muddle and its effect on the manufacturing interests since the Gaffney explosion, says: "Nearly two-thirds of the boilers in use in the suburbs have flat cast iron heads, and the owners are in daily fear that an edict will be promulgated which will put a temporary stop to their operations."

We learn that a boiler explosion took place about the 19th of July, 1881, at Watertown, near Marietta, Ohio. The boiler of a saw mill was blown to atoms. Hiram Brockway and Eugene Barclay were instantly killed. Three others, Isaac Johnson, Robert Alexander, and William Conner, were fatally injured. Johnson has since died.

The June number of the Hartford Steam Boiler Insurance Company's circular contains the inspector's report for April, 1881, by which it appears that 3,960 boilers were viewed, of which 1,593 were inspected internally and externally, and 528 dangerous defects were found; notable among them were 23 safety valves in dangerous condition, and 74 boilers without steam gauges. 39 boilers were condemned in April. There is also notice of 8 explosions in May, and one illustrated explosion that occurred in 1877, in Brooklyn, N. Y.

### MISCELLANEOUS INVENTIONS.

Mr. William A. Thompson, of Brooklyn, N. Y., has patented an improved fire escape, which consists of a cradle formed of curved side bars connected by cross bars and provided with supporting bars or legs, the cradle being hinged to a rod attached to the window casing below the sill, and having a ladder attached to its free end and provided with means whereby the fire escape can be extended from the window when required for use, and folded down inside the window when not required for use.

An improved baling press has been patented by Mr. Nelson Arave, of Hooper, Utah Ter. The object of this invention is to press hay and other materials in successive bales by the continuous forward movement of the driving mechanism.

Heretofore alloys, in which lead forms a component part have been used for coating cast and wrought iron to protect the same against oxidation, and zinc and tin alone are in common use for this purpose; but several objections and difficulties attended the use of these materials when applied by the methods now known—as, for instance, when zinc or tin is used and applied directly upon the iron the zinc attacks the iron in such manner as to injure its durability and tenacity, and this is also true of such alloys as antimony, bismuth, and lead, and nickel, tin, zinc, and lead; and, besides, in applying these alloys or the zinc a dross is formed in the molten baths, which is troublesome to remove, and results in a loss of metal, and wrought or cast iron has never been successfully coated with unalloyed lead. Mr. William Frishmuth, of Philadelphia, Pa., has patented a process of thoroughly and effectively coating cast iron or sheets of wrought or cast iron or other metals with pure lead, or with zinc or tin, in such manner that the metal coated will be protected against oxidation and its durability and tenacity preserved, and in such manner that there will be no formation of dross in the molten baths. The invention consists essentially in protecting or preparing the surfaces to be coated by depositing upon them, by electroplating or otherwise, a thin coating of nickel, or an alloy of nickel and aluminum.

It is well known to workers of gold and silver ores that the pan amalgamation process always results in a very considerable loss of the precious metals and of the quicksilver, the loss of the former being in a great measure due to the fact that the particles of metal are coated with some substance that repels the quicksilver or prevents its contact with the metal, and the loss of the quicksilver being principally due to the "flouring" of the latter, because of its trituration in the pans and because of the presence of certain interfering mineral substances that coat the globules of quicksilver and prevent their reunion. Messrs. William H. C. Mathews, Charles W. Ayres, and Madison D. Campbell, of Bodie, Cal., have patented a cheap and effective compound to be used for preventing this loss of both the gold and silver and the quicksilver, by brightening the particles of the precious metals and by preventing the coating of the quicksilver globules.

An improved apparatus for separating sulphurets in ore washing has been patented by Mr. William F. Devan, of Gwin Mine, Cal. The object of this invention is to improve ore washers and save the sulphurets by an operation that is both continuous and economical.

An improved bird cage has been patented by Mr. John B. Abernathy, of Covington, Ky. The object of this invention is to protect the animals confined in cages from suffering by external violence and from being preyed upon by larger animals.

An improved adjustable piston, which is so constructed that the packing of the same can be depressed and spread proportionately as it wears off, by adjusting the piston accordingly, so that the packing will always fit closely in the pump-cylinder, has been patented by Mr. James Preston, of New York City. A packing of any desired size is held between the opposite convex or flat conical surfaces of the plates, and in case this packing becomes worn off it can be spread by forcing the disks toward each other.

### The Eyes of Science.

In a communication to the *Herald*, describing the wonders of the eyes which science has fashioned—telescopic, microscopic, spectroscopic, and, most marvelous of all, photographic eyes—Mr. Richard H. Proctor says:

Ordinary human eyesight, even when strengthened and extended by optical devices, possesses certain imperfections and is used under certain difficulties. For instance, at least a tenth of a second is required for the eye to take a full look at any object. Even if the eye could see an object in less time the image remains at least this time impressed on the retina. Thus the eye cannot see an object which moves very rapidly, and even when an eye sees an object moving not too rapidly, or moving in a circle so as continually to renew the impression (as where a burning rod is whirled round in a dark room), the object is not seen as it really is, but the successive images, owing to the persistence of luminous impressions, are blurred together into an image utterly unlike the real object. Again, when an object is rapidly changing in shape the eye is often quite unable to see distinctly any one of the shapes which the object assumes. Thus scarcely one of the attitudes of a galloping horse can be seen by the human eye, insomuch that the finest pictures of a charge or a race show not one attitude which a horse really assumes when galloping. Yet again, the eye is often prevented from recognizing the true shape of an object which is itself at rest, by reason of continual fluctuations in the medium through which the object is seen, as for instance when the telescopic image of a sun spot is examined through disturbed air, or when smaller details of the solar surface are examined through the air at its very stillest.

#### OPTICAL DIFFICULTIES.

In all these cases the real trouble is that the eye requires a certain definite though short time in which to take in, as it were, the visual image, and that during this time the object forming the image is changing in form, either actually or apparently. On the other hand, there are cases of an opposite kind, in which the eye fails to recognize objects or their details because of their exceeding faintness, the eye gaining nothing by the length of time during which it is in action. Thus if we look at a point in the heavens at night where there is a telescopic star the eye fails to see that orb if directed toward it during the tenth of a second (the period necessary for distinct vision under ordinary conditions), nor can the eye see the orb better if directed toward it for a second or for a minute or for an hour. Now science possesses an eye free from these defects, by means of which ordinary vision may be made to see an object as it would be seen if the human eye could take in the image in the thousandth part of a second, or even less time, or, on the other hand, as it might be seen if the human eye could look steadily for an hour or more, gaining distinctness of vision precisely in proportion to the increase of the time during which the eye was used.

#### A LIGHTNING GLANCE.

For instance, in lecturing on the sun I have been able to tell my hearers that a certain photograph of the sun's surface had been so rapidly taken as to show details which no astronomer had ever actually seen or could see, even though he used the most powerful telescope ever made, and gave to the study of the sun with such an instrument every moment of his working life

#### A LONG GAZE.

On the other hand, but a few weeks ago I was looking in Dr. Henry Draper's observatory at a picture of the great nebula in Orion which had been two hours and twenty minutes forming itself on the retina of the photographic eye of science—in other words, the negative had required an exposure of this duration. I say nothing, though I might well say much, on the mechanical skill and ingenuity required to retain the telescopic image so long unchanged in position, though all the time the diurnal motion of the heavens was carrying Orion round the heavens at the rate (in reality a slightly greater rate) at which the sun moves in the skies, nor do I dwell on the optical and physical difficulties involved in the task which Dr. Draper had thus successfully achieved. The point I wish chiefly to dwell upon is this, that where such a photograph is taken science does in reality employ an eye which can give hours to a single look. And let it be noted that we see now but the beginning of the use of the photographic eye, which can see in the five-thousandth part of a second if need be, or if need be can rest its gaze for many hours on the same object, seeing more and more as minute after minute passes on. Yet already the swifter view of the photographic eye has shown details which the unaided human eye, or that eye aided only by the telescope or microscope, could never see, while the steadfast gaze of the photographic eye has revealed what it has been given to no human eye to see by direct vision.

#### SEES AND DELINEATES.

Note, further, that the photographic eye in seeing, delineates also, whereas often enough the eye keenest to see is but little skilled to guide the hand to delineate what is seen, and yet oftener the ordinary eye can obtain but so brief a view of an object that there is no time to draw what is seen without trusting to memory, which in such matters is too often treacherous. The finest picture of the solar rice grains as drawn by any human artist has much less value than have Janssen's instantaneous photographs of the sun's surface. The best picture of the great Orion nebula—which, despite Mr. Delarue's opinion in favor of the view taken with Lord Rosse's telescope, I consider to be unquestionably Mr. Trouvelot's picture taken with the great Washington telescope—shows no details which are not clearly recognizable in Dr. Draper's beautiful negative, while skillful though Mr. Trouvelot is as an artist, nature has surpassed him in presenting truthfully not only all details but all grades and varieties of shading. And these are but illustrative instances, belonging, too, but to the beginning of the application of photography to science.

## IMPROVED CAR STARTER.

No subject is more deserving of the attention of inventors than that of starting our heavily laden street cars after they have come to a full stop, and singularly enough no subject has been more bunglingly treated. The two essential qualities of a car starter are simplicity and durability. Complicated and expensive mechanism for this purpose is entirely out of the question, as no class of devices are subjected to greater wear or greater inequalities of strain.

The car starter shown in our engraving happily combines all the essential qualities, and has proved itself by actual and continued use to be adequate to all the requirements of a device of this character. The clutch employed is of novel construction, and the leverage is equal to the radius of the wheels.

In the engraving Fig. 1 is an elevation of a portion of a car, showing the clutch of the starter in section. Fig. 2 is an inverted plan view. Fig. 3 is a perspective view of the clutch and clutch lever, and Fig. 4 shows the inner end of the clutch lever.

The axle, A, with which the apparatus is connected, has attached to it a sleeve, B, and a clutch, C, which may be rotated around the enlarged central portion of the sleeve.

In connection with this clutch there is a lever, D, the central pivoted end of which is pivoted in a slot in the clutch, C, in such a way as to have freedom of motion to a certain extent up and down. Upon the outside of this central portion are winged flanges which embrace the sides of the clutch, C. A pivotal pin, passing through these wings as well as the central portion, and clutch, C, give steadiness to the lever, D, and prevent it from lateral movements. At the extreme inner end of the lever, D, there is a recess, of a semi-globular form, elongated in the direction of the length of the lever. A ball, *a*, having freedom of movement, is placed between this recess and groove, around the central portion of the sleeve, B. This ball, in the movement of the lever at the proper point, is clamped against the groove, and, having freedom of movement in its own recess, presents continually a new wearing surface, and avoids the inconvenience and bad results which would follow if no such ball were employed.

By reason of the longitudinal form of the recess, the ball, in the upward movement of the lever, is brought into engagement in the upper part of its recess with the groove in the sleeve, and therefore the resistance of the ball, being in a slightly angular direction, is increased to such an extent that it never slips.

The outer end of the lever, D, is slotted to receive the link of the chain, E, which is held by a bolt, so that if it is necessary to shorten the chain at any time the bolt may be withdrawn, and then replaced through another link of the same chain. The chain, E, passes over a pulley secured to the bottom of the car, is attached to a rod, F, which, in turn, is attached to the draw bar, G, by a pivotal connection. The inner end of the draw bar connects with one end of the lever, D, pivoted to the bottom of the car, and a spring, with this lever between its pivotal point and its free end, presses it back, and draws back the draw bar, and holds it in this position when no force is applied to it.

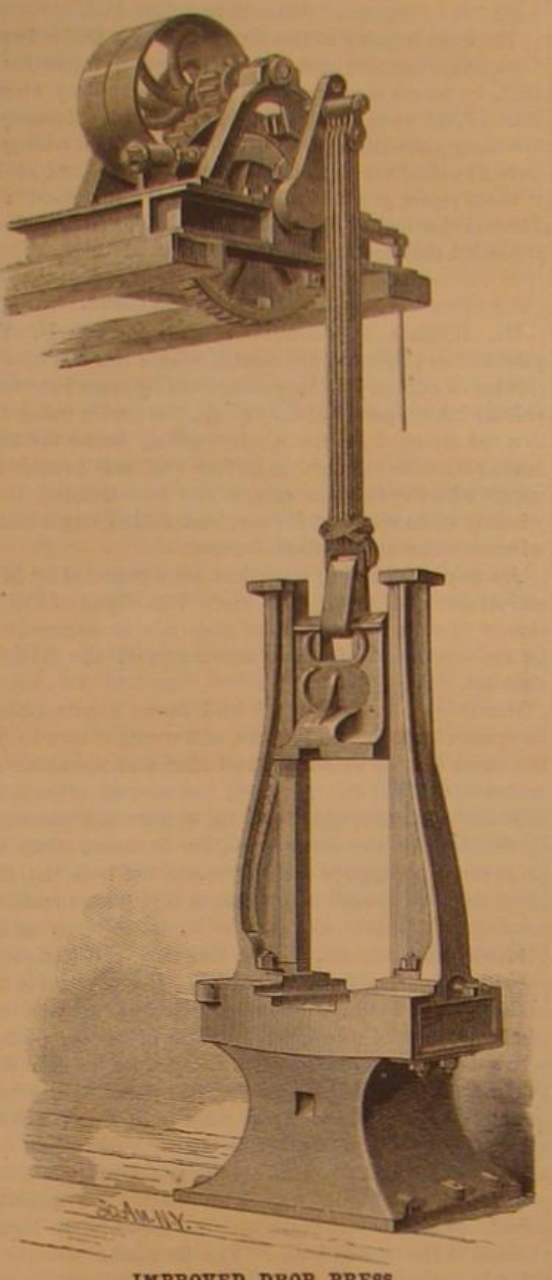
It will be seen that with any forward motion of the draw bar the lever, D, will be raised, and the power for the moment will be exerted to great advantage, and the car will be started easily without strains or shocks on the horses, harness, or car.

To check any retrograde movement of the car upon up grades, an auxiliary ball, *b*, is placed in a cavity in the clutch, C. When the car makes the slightest movement backward the ball, *b*, wedges in the cavity and stops the car.

The starter is not intended to supersede the brakes, but to be used as supplementary to them. The main object is to lessen the labor of overcoming the inertia at the initial of the forward movement, and also to equalize the draught after the loaded car has been put in motion.

There is also an attachment by which the driver is enabled to reverse his car by throwing the lever out of gear—and preventing the locking of the wheel—simply by a pressure of the foot. If by any neglect on his part he should fail to put it in gear again, it acts automatically as soon as he attaches the horses to the draught bar.

The ball of the checking device is thrown out of position to engage the clutch by means of a rod attached to the yoke, H, and extending into the ball cavity. This yoke is operated by a pedal, L, through the medium of the angled levers, K, I, the rod, J, and a short section of chain connecting the double arm of the lever, I, with the yoke, H. By means of this mechanism the checking device may at any time be thrown out by the pressure of the foot on the pedal, L, and should it be desirable to keep it out of engagement with the clutch, the catch on the pedal is hooked under a plate in the platform.

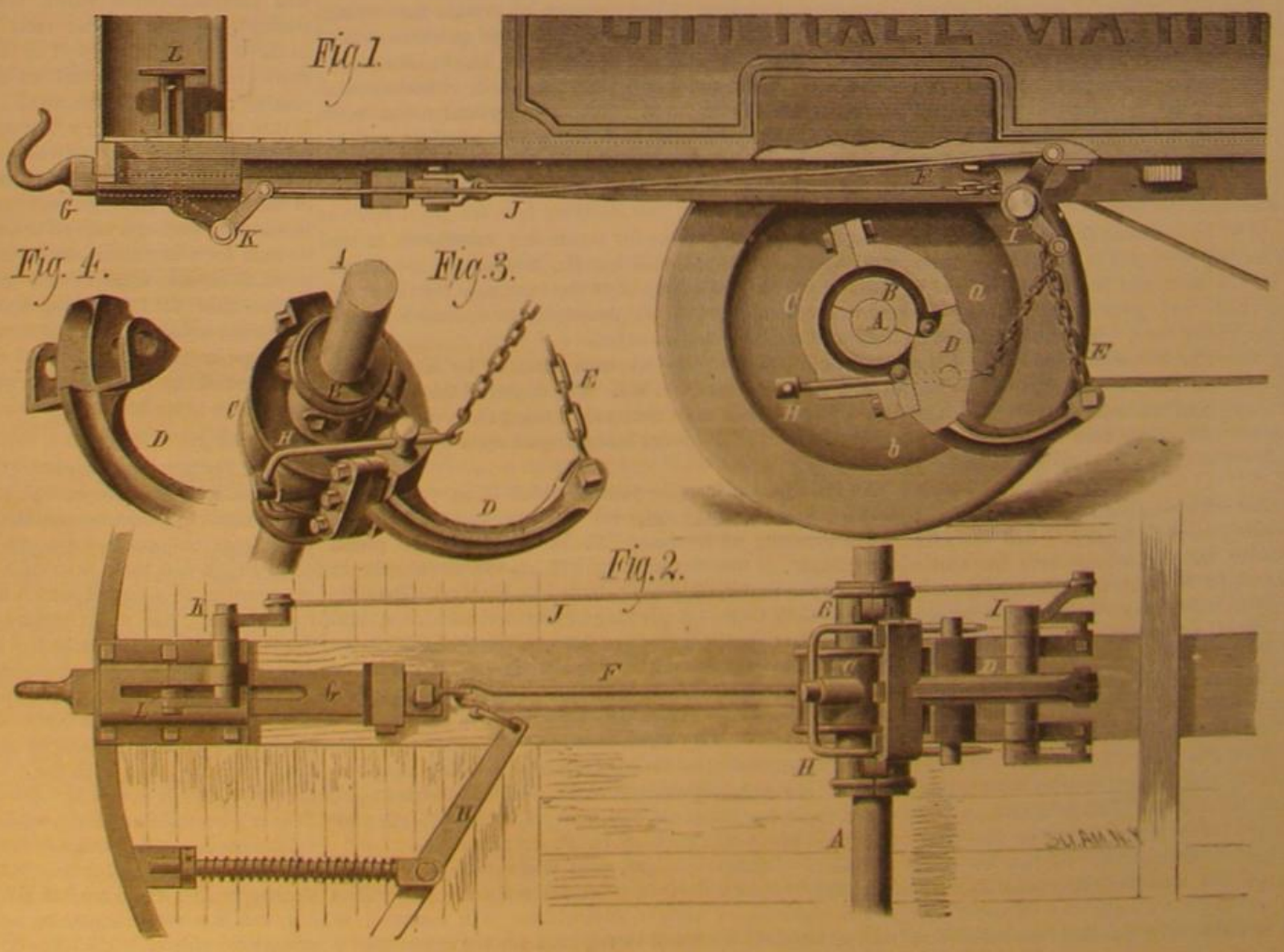


IMPROVED DROP PRESS.

One of the great advantages gained is that it removes the concussion from the car, preventing the sudden jerking of passengers inside when the car starts up. So smoothly does it start that even a lady could get on at the time without inconvenience. Another advantage is that passengers standing up are not jostled and thrown around the car, as all the jerking and pitching is done away with. The explanation of the matter is simply that it moves the car to move the load, instead of moving the load to move the car.

This improved car starter is in continuous use on some of our leading horse-car lines in this city, giving great satisfaction. This starter has been applied to some of the car lines in Baltimore with great success, and it should meet the approval of all street railroad companies.

Further information in regard to this useful invention may be obtained by addressing P. B. Shaw, Grand Hotel, 31s street and Broadway, New York city, or the American Car Starter Co., Williamsport, Pa.




HILL'S CAR STARTER.

## NEW DROP PRESS.

The variety of work that can be welded and forged under a drop press, and the great economy and rapidity with which it can be done, have worked a complete revolution in the production of steel and iron shapes. In no other way can duplicates be made so surely to replace missing or broken parts.

We illustrate a new drop press which is a great improvement over those now in use. The patent connection between the crank pin and hammer is slightly elastic and acts as a cushion.

The right tension can be much easier attained and changes can be more readily made than with the strap in common use. Its first cost is less, and when worn out can be quickly replaced at a small expense. We are informed that quite a demand has arisen for this connection to replace old straps on lifters of drop presses of other manufacturers.

Internal steel ratchets—whose teeth are much stronger than those of external ratchets—are used in constructing this press, and the ratchet being attached to the rim of the main driving gear the transmission of the strain through the arms of the gear wheel is avoided. The greatest strain on crank and ratchet drop presses comes when the dog fails to catch a tooth at its furthest rebound, then it falls back to the next tooth. This ratchet contains forty-five teeth, and hence the falling back in this machine is always through a very small distance. This press is manufactured by Williams, White & Co., Moline, Ill.

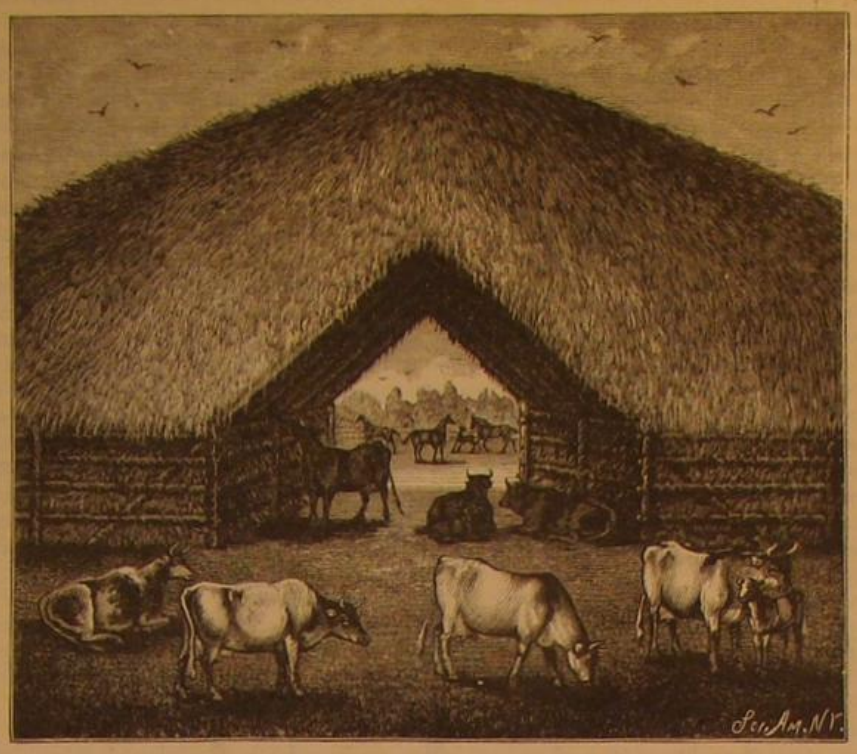
## Steam Wagons.

The Colusa *Sun* says: "After all his experiments, Captain Roberts, of the San Joaquin Company, is still an enthusiast about his steam wagon enterprise. We had a conversation with him some time ago, and he thinks that roads suitable for his wagon can be built very cheaply. While the wagons run and pull very heavy loads on common roads, he thinks of digging two small graded ditches and filling with gravel, which will pack as hard as iron, and give a solid road for each of the broad wheels, and for the wagon wheels that follow with the loads. The Chico *Enterprise*, of Tuesday, has an item to the effect that this 'steam wagon has been thoroughly overhauled and improved at the Union Iron Works, Sacramento, and on a recent trial worked satisfactorily. Its weight is 17 or 18 tons, and it is calculated to haul 50 tons of grain at each trip. It will be taken to the Upper Sacramento valley in a day or two, and will engage in grain hauling between Riceville and McIntosh's Landing.'

"Capt. Roberts will, if this one shall prove the success he anticipates, put on wagons to run to all the principal landings on the river, and thus cross-section the entire Sacramento valley. He will have, in effect, a freight railroad across the valley, from foothill to river, every eight or ten miles. We sincerely hope that the wagons may prove successful, as it would be one of the grandest things for the Sacramento valley that could be imagined; that is, always provided we can keep the river navigation from being destroyed."

### SHELTERING HAY RICK

A straw or hay rick that can be used as a shelter for cattle, horses, etc., is shown in the annexed engraving. The frame of the stack consists of two square fences with a passage way between them. The passage is covered by a peak roof framed or tied, the rafters being formed of fence rails or thick poles, with their lower ends set a small distance in the ground. The hay is placed in the spaces inclosed by the fences and upon the rafters, and the stack is built up to the ordinary height. Very long stacks can be provided with two passage ways if desired. It is considered advisable to construct the frames of these hay stacks as permanent structures.



SHELTERING HAY RICK.

### Pharaoh's Serpent and the "Sea Snake."

We have heard a good deal about the amusing chemical toy "Pharaoh's serpent," both harmless and injurious, from its unhealthy vapors given off in the process of burning, but little about another very ingenious and singular chemical phenomenon, discovered and exhibited by the late Prof. Graham, Master of the Mint, which might be termed, in contradistinction to Pharaoh's land serpent, the "sea snake," as it is produced under water. His experiment went to show the prodigious amount to which the metal palladium will absorb hydrogen: an amount exceeding by some hundreds of times its own bulk. Two ribbons of palladium, attached to the two poles of a battery, were seen loosely coiled in a water bath. The current was turned on; the ribbons took in so much hydrogen that they expanded, uncoiled, and stretched themselves across the bath, as if alive. The current was reversed, the hydrogen was thrown off, and the ribbons resumed their coil. They might have been compared to a couple of writhing worms. The sight was amusing; but it exemplified the researches by which Prof. Graham has thrown light on an important question in cosmical science, and led him to the discovery of the metal to which he has given the name of "hydrogenium." "What do you think," wrote the Professor to Hofmann, "of a metallic hydrogen, a white magnetic metal?" The condensation of hydrogen in palladium, and the discovery of the occlusion of hydrogen in meteoric iron, confirmed the conclusion to which spectrum analysis had previously conducted us, that the meteorites came from an atmosphere of incandescent hydrogen existing under very considerable pressure. Graham's fame as one of England's greatest chemists justly rests upon this important discovery.—*Monthly Magazine.*

### THE SEA LAMPREY.

The lampreys form a small group of hardly more than a dozen varieties, and are the most imperfectly developed, and occupy the lowest grade of all fishes, with the exception of the Lancelet. Their skeleton consists entirely of cartilaginous material. They are destitute of ribs, shoulder girdle, real jaws, and scales, and are possessed of only one nostril, and their gills have the form of fixed sacs. In their habit of feeding and attaching themselves to the bodies of other fish, from which they rasp off the flesh and suck the juices, they become very suggestive of the leech.

The body of the sea lamprey is olive-green, mottled with dark brown. Length from two to three feet; numerous rows of mucous ducts on the head and body. The mouth, when not attached to any object, forms a longitudinal fissure; when attached it is circular in form. The teeth are of various kinds, generally disposed in concentric circles. In the throat, and partially closing it, is a group of three large teeth. (See illustration.) Lips fleshy, with a distinct and slightly fimbriated membrane, and beneath a deep triangular fossa, having a fold on each side.

Lampreys are frequently found attached to sturgeon, from which they suck the slime and mucus exuded in abundance through the pores of the sturgeon. All the skate family provide favorite food for the lampreys, in whose bodies they rasp out deep wounds, which often produce ulcerations. The young pass through several changes before becoming perfect lampreys. At first the young are destitute of teeth and have only rudimentary eyes.

With the Italians and French the lamprey is considered a great delicacy, whereas in England only the poorer classes eat it. In this country it is valued only by a few epicures, and is rarely seen on the fish stands. Sothern, the actor, considered it a great luxury, and was known to pay very high prices to obtain it, being of the opinion that it contained more brain food than any other fish.

It is related of the Roman emperors that, so great was

MOUTH AND TEETH OF SEA LAMPREY.

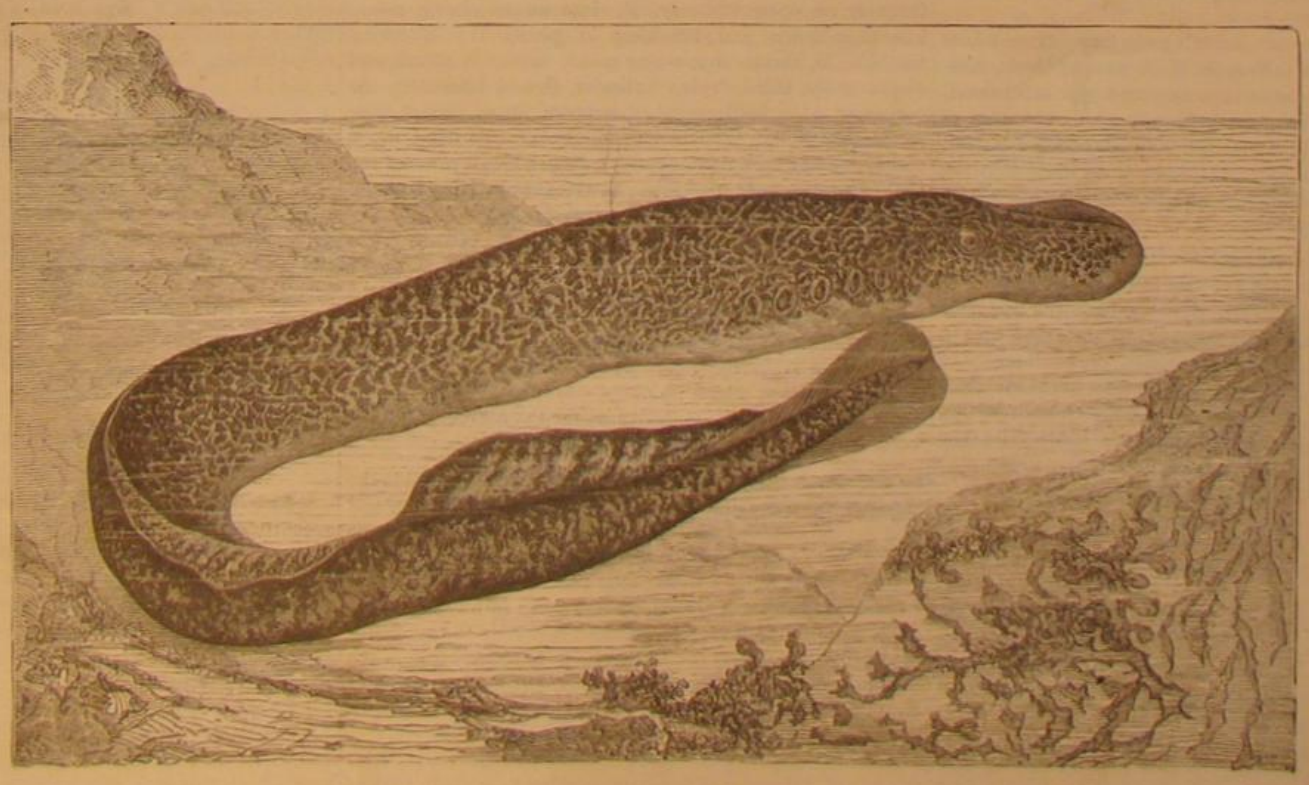
their valuation of the lamprey, both as a luxury and stimulating food, artificial ponds were constructed in which to fatten the lampreys, the principal food used being well fattened living slaves, on whose bodies the eels would fasten and feed, affording an enjoyable pastime to the noble Roman.

The only place in New York city where the lamprey is served up is at the Grand Union Hotel.

At the next dinner of the Ichthyophagous Club, the sea lamprey will receive special attention from the French cooks, and is to be served in every known style.

The negroes of the South have great respect for the lamprey eel on account of its supposed medicinal qualities, the skins being in great demand as infallible cures for rheumatism and kindred ailments. The skins are bound about the ankles, wrists, and neck of the patient while fresh from the body of the eel, and are worn for long periods of time, in fact often till they drop off.

In the months of March and April the lampreys begin ascending our fresh water rivers and streams that empty into salt water. Here they construct what might be called a nest, composed of stones piled up in a heap. These stones are carried from a distance by means of their sucking mouth. In these conical heaps of stones they deposit their spawn.



THE SEA LAMPREY.

### Botanical Sources of Tonga.

Some time ago a native medicine called "tonga" was introduced into England and the United States from the Fiji Islands, where it has long been in use as a remedy in neuralgic affections. No clew to the origin of this drug, which belongs to the vegetable kingdom, has hitherto been obtained, as the natives have jealously guarded the secret. According to a recent number of the *Gardeners' Chronicle*, however, the botanical source of the medicine has now been found out through specimens sent by Mr R. L. Holmes, and submitted to Baron Von Mueller for identification.

The component parts of tonga consist of two plants only. The first, called by the natives "Aro," is *Premna taitensis*, and belongs to the order verbenaceæ. Mr. Holmes states that it is, in open dry places, a shrub, flowering when quite small, but near water-courses becomes a tall tree, the timber of which is used in building, the inner bark being the part used in medicine. The other plant, known as "Nai Yalu," or "Walu," is an Arad, the *Raphiodophora vitiensis* of Seemann. It is a creeper, growing freely in sheltered places, climbing over stones and the like till it finds a tree, when it changes its nature. From a small vine, not thicker than a quill at the foot of a tree, it gradually expands, the stem growing to one or two inches in diameter, and the leaves, as many feet long, become pinnatifid, forming a handsome plant. It is the dried scraped stems of this plant that form the second ingredient in tonga.

### Preservation of Flowers with their Natural Form and Color.

One of the processes consists, says *La Belgique Horticole*, in inclosing the flower or flowers in a glass jar provided with an air-tight, hollow ground-glass stopper, the cavity of which is filled with quicklime wrapped in leather. The object of the lime is to absorb the small quantity of humidity already existing in the jar or which might enter on a removal of the stopper. The dry air, deprived of its carbonic acid, occupying the jar, seems to brighten the color of the flowers and preserves them in their natural colors.

Mr. Cornelis's other method consists in burying the flowers carefully in sand and then drying them. The most convenient receptacle that he finds for this purpose is a piece of paper wrapped in the form of a cone, the point being bent over so as to form a truncated cone. The desiccation may be effected at a temperature of 90° to 100°, but the method which gives the best results is desiccation in a vacuum in the presence of commercial sulphuric acid or any other substance which absorbs water with avidity, such, for instance, as chloride of calcium or caustic potash. The flower once dried, which will be in eight or ten days, it must be removed from the sand with great care, for it is very fragile. The dust remaining on the petals is removed by allowing coarse sand to fall upon them from a small height. After this species of washing the specimen has received all the treatment necessary, and in this state may be preserved indefinitely if it be inclosed in a hermetically sealed jar along with a little quicklime.

The preservation of color in dried flowers, however, will not in all cases be attended with success, the action of light upon them being very variable. Certain kinds stand the light perfectly—even the direct light of the sun; others are even influenced by a diffused light, and there are some again that are discolored even in partial darkness. Three plants, *Abutilon sellowi*, *Fritillaria imperialis*, and *Vanda suavis*, exhibit an unlooked for phenomenon. When dried, these flowers become of a reddish-brown, but when they are exposed to the sun they assume a tint which is quite like their original one, except *Fritillaria* (the crown-imperial), which becomes violet.

## MECHANICAL INVENTIONS.

Mr. George W. Greene, corner 41st street and A. V. R. R., Pittsburg, Pa., has patented an improved machine for cutting tapered cork. This ingenious machine cannot be described without engravings.

A means by which the felly of a carriage, wagon, or other similar wheel may be enlarged for the purpose of tightening the tire of the wheel, has been patented by Mr. William Downham, of St. Johns, Mich.

A velocipede designed to be operated by two persons standing and applying their whole weight to the treadles, has been patented by Mr. Oliver U. Guinand, of Lawrenceburg, Ky. This vehicle is more easy to mount than the velocipedes in common use, and affords conveniences for carrying small parcels and packages.

An improved motive power has been patented by Mr. Obadiah W. Gibson, of Kellyville, Texas. This invention relates to improvements in motive powers by which the entire power of the horse is thrown on the shaft that operates the gear mechanism, which may be applied to the running of cotton gins, grist and flouring mills, and other purposes. The invention consists of an inclined wheel applied to a center shaft that turns in fixed bottom bearings and adjustable top bearings, and transmits the power by a crown wheel and gear wheels and shafts in one or both directions.

Messrs. Charles C. Henderson and Jacob R. Henderson, of Arkadelphia, Ark., have patented a machine adapted for measuring heavy cloths, bagging, and similar materials in lengths, as desired, in place of the usual method of measuring by hand. More particularly the object is to wind the material from the roll upon a suitable drum, measure the material as it is wound, and provide an indicator of the amount rolled off, so that the desired quantity can be wound and then cut off.

A simple machine for rapidly peeling vegetables or fruits, such as potatoes and apples, has been patented by Mr. Hervey Law, of Chatham, N. J. This machine is especially designed for peeling potatoes, which are usually of very irregular forms and sizes; and the invention consists in means whereby the cutter may be quickly set to a longer or shorter travel to correspond to the length of the potato.

An improved cloth-measuring machine has been patented by Messrs. Charles C. Henderson and Jacob B. Henderson, of Arkadelphia, Ark. This improvement relates to machines for winding off and measuring bagging and heavy bolt goods, and is designed to save the time and labor required in doing such work by hand. It is specially calculated to relieve the counting shaft of weight from the passing web.

An improved device for removing fire damp from mines has been patented by Mr. Francis Wodiczka, of Gratz, Austria. The invention consists in arranging a pipe or channel, provided with a series of suction funnels, along the ridge of all the galleries and adits of a mine, which channel is connected with a side channel, which, in turn, leads into the main or receiving channel, which is in communication with the gas flue or chimney.

### Hot Water for the Heart.

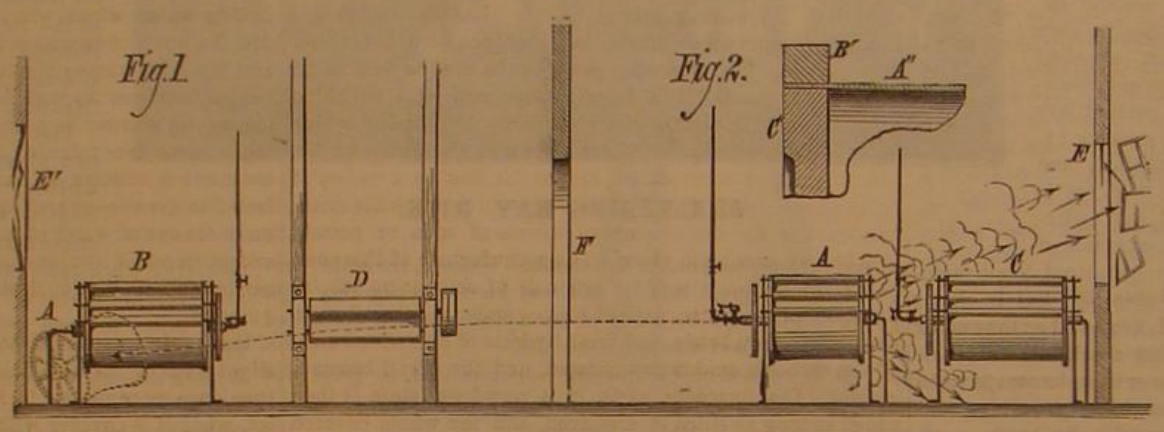
In a letter to the *Lancet*, Dr. A. Paggi records the following observation: He states that in Paris he saw a case in which, under the inhalation of chloroform, the heart ceased to beat, and artificial respiration for ten minutes failed to restore circulation, when Dr. Labbé dipped a large cloth in boiling water and applied it to the region of the heart, with the result of immediately restoring the action of that organ.

THE London *Iron Trade Exchange*, of recent date, publishes a complete list of blast furnaces in and out of blast in the United Kingdom. From the returns it appears that out of the total 943 furnaces built, 563 are in blast and 380 are standing. There are probably 40 furnaces in various districts which are not included in the returns, but none of these have been in blast for many years, and they will never be relighted; others are dismantled, and some have never been completed. The returns from Derbyshire were imperfect, and the figures relating to that district may not be quite accurate, but as regards other districts, the figures, says the *Exchange*, may be relied on.

## EXPLOSION OF A STEAM DRYING CYLINDER.

BY S. N. HARTWELL.

On the afternoon of July 10 a steam drying cylinder in the Staten Island dye house of Barrett & Nephews, about one mile south of the steamboat landing at Port Richmond, S. I., exploded, seriously injuring five persons. The sketch, Fig. 1, shows the cylinder at A, one of three driven by a small steam engine and used for drying piece goods. Fig. 2 is an enlarged detail of the head joint. The cylinder was made of copper, tinned on its exterior surface, 36 inches diameter by 48 inches long. The copper shell was about one-tenth of an inch thick, brazed at its longitudinal seam and fixed upon a cast iron spool by means of wrought iron hoops shrunk upon the copper over the spoolhead shown in section, Fig. 2, in which B′ is the hoop, C′ the cast iron head, and A″ a section of the copper. The copper was calked at the edge, between the hoop and head, to make it steam tight, and to support the head. The heads were flat, something less than three-quarters of an inch thick in the web, thickened at the periphery, as shown in Fig. 2. The barrel of the cast iron spool was hollow, having hollow wrought journals. The inlet and outlet pipes for the steam were half inch, and entered the journals through stuffing boxes. A small safety valve was fixed to the inlet pipe. This cylinder is said to have borne a test pressure of 100 pounds to the square inch, applied by the makers. This, however, may be an error. The cylinder was about three years old, but had lately been to the maker to be retinned, since when no one remembers to have seen steam escape from the safety valve, although the weight was set for a light pressure. The cylinder was located with reference to its fellows at A, and about 150 feet from the steam boiler that supplied it with steam through a 1½ inch main and a half inch branch pipe.




EXPLOSION OF A STEAM DRYING CYLINDER.

The safety valves on the steam boilers, of which there were four horizontal tubulars in this system, were weighted to blow at a limit of 50 pounds per square inch.

A small drip pipe was tapped into the barrel of the spool of the exploded cylinder at a right angle to its axis; that was for the purpose of carrying off the water of condensation, which was forced out intermittently as the end of the pipe dipped into the water in the bottom of the cylinder at each revolution, steam escaping in the interim. There was a valve opening inward to prevent collapse in case of an accidental vacuum in the cylinder.

On the day of the accident the cylinder, A, had been a short time in operation after standing for considerable time, when the right-hand head blew out as shown, knocking the cylinder, C, against the wall and breaking the frame. The exploded cylinder flew in a direct line of its axis to the left through an open archway, F, into an adjoining room, knocking down and breaking in pieces the squeezing machine, D, and its supporting posts; thence it struck and displaced the third drying cylinder, B, and landed in the corner, at A′, a badly smashed concern, about 40 feet from its starting point. The concussion broke two windows, E and E′, one in each room nearly in line, while a piece of the broken squeezer, D, was shot endwise through the window, E′, into the dye house, breaking a man's arm.

During the experience of Captain C. W. Kennedy, the secretary and superintendent of the works, and that of the dyer, Mr. E. Parker, covering the thirty odd years of the existence of the Barrett dye house, drying cylinders have occasionally given out in a mild way, sometimes even leaving their places from the effect of the escaping steam. The absence of water, which no doubt was present in considerable quantity in this case, accounts for the difference.

THE HYPOTHESIS

in this case is that the safety valve had been damaged in the resetting or the removal of the cylinder for retinning, and that the outlet pipe for steam and water subsequently became choked with a wad of some kind that found its way into the cylinder while repairs were going on. Water accumulated from condensation of steam, which leaked into the cylinder while stopped, and on starting, the pressure in the generator being 40 to 50 pounds per square inch, gradually rose in the cylinder till its strength was exceeded, when it gave way as steam boilers sometimes do at the weakest point. The work of destruction is then accomplished by the explosion—sudden expansion—of the water which is suddenly relieved, the heat due to the difference of pressure escaping from every part of its mass with great violence.

## PROTECTION FROM LIGHTNING.

During the present summer thus far no very remarkable damages from lightning in this part of the country have been reported. A few buildings have been struck and a few persons killed; but on the whole the losses of life and property have, we believe, been less than for some years past.

The oil regions of Pennsylvania have been remarkably exempt. Last season, as will be remembered, many oil tanks were struck and their contents burned. But this year, up to the present time, we hear of no oil burning from lightning. We believe that in quite a number of cases the owners of tanks have put up rods and earth connections, with the hope of saving their property. We should be glad if our correspondents in the oil country would send us notes of such improvements and take pains to observe and report the results if thunderstorms take place.

On the 12th of July a heavy thunderstorm passed over the cities of New York and Brooklyn with frequent and powerful discharges of lightning. The thousands of telegraph and telephone wires caused a general diffusion of the electric currents about town. In the SCIENTIFIC AMERICAN office there was a good deal of electrical snapping on the telephone conductors; while at the general Telephone Exchange and also at the Western Union Telegraph office there was an extensive display of this sort of fireworks. At all these offices the wire terminals are located in close proximity to conductors that are well grounded in the earth, and when lightning follows the wires into the buildings it simply leaps, with a spark and snap, to the ground conductor and is dispersed. During the above storm the great seaside resort, near New York, known as the Manhattan Beach Hotel, situated at the edge of the ocean, Coney Island, was struck by lightning; fortunately no serious damage was done. Several thousand persons had sought shelter from the rain within the saloons and under the piazzas of the immense structure. A blinding flash and a deafening roar informed the multitude that the house had been struck. But none were injured. The building is 600 feet long, 100 feet broad, three stories high, and although well provided with almost every other convenience and apparatus for safety, no precautions in respect to protection from lightning had been adopted. The several spires or steeples that rise from different parts of the building were surmounted by ornamental sprays or branches of iron, which would have formed excellent lightning rods had they been connected with the earth. After the storm we made a careful examination of the premises, and found that the lightning had struck the iron ornaments of the central tower, ran down the iron staff thereof on to the wooden timbers within the spire, where the iron terminated; thence the electrical current continued down on the wooden rafters, splintering the same for a distance of about 30 feet to the ceiling of the topmost sleeping room, where it burst through the plastering and took to an adjacent gas pipe, on which the current went to the ground without further damage. It is obvious that all the iron work of the spires and roof trimmings should be connected by rods with the metal pipings in the ground, and doubtless this will now be done. The escape of the tower from fire, with the iron staff terminating in the middle of a mass of dry timbers, is quite fortunate.

We will here repeat the golden rule which must be observed if protection from lightning is expected, namely, *the rod must have a large area of conducting material for its underground terminal*. Everybody will understand the folly of embedding the extremity of the rod in the woodwork of a steeple, as in the foregoing example. But the majority of rods are not much better arranged, as the common practice is to stick the terminals of the rods two or three feet down into dry earth and call the job complete and safe. But the truth is, it is very unsafe; it is not a sufficient electrical earth connection. The extremity of the rod should be joined underground by soldered joints to the metallic water pipes, gas pipes, or drain pipes; in the absence of these metals then long trenches should be made, in which conducting material should be placed, such as a continuous layer, a few inches deep, of iron ore or coal dust—hard coal or charcoal—and the rod should be extended along the trench, in contact with the coal, which is a good conductor.

### A Large Monolith.

At a granite quarry in Westerly, Rhode Island, there was recently detached a monolith 150 feet long, 10 feet wide, and 8 feet thick, weighing over 1,000 tons. These dimensions greatly exceed those of the Obelisk of Semiramis, the largest of the Egyptian monoliths. The Westerly stone, a proprietor, Mr. H. Q. French, says, was loosened by one oblong blast-hole in such a simple and perfect manner that the theories and conjectures advanced by many as to the methods of the Egyptians appear absurd. It contains over 12,000 cubic feet of granite, which, cut into smaller blocks, will fetch about $30,000. Mr. French is quite positive that it could be brought to this city, finished as an obelisk, and erected for about $150,000.

### Diatoms.

Henry G. Hanks, State Mineralogist, Cal., writes as follows to the *Mining and Scientific Press:*

A diatom is generally admitted to be a single celled plant, bearing a singular relation to the animal and even to the mineral kingdom, being considered by some to belong partly to the latter, and regarded as a vegetable crystal, differing only from minerals in having the power of locomotion, and of multiplying by separation. Kutzing says: "In comparing the arguments which indicate the vegetable nature of the diatomaceæ with those which favor their animal nature, we are, of necessity, led to the latter opinion."

In connection with the idea that the diatoms pertain somewhat to the mineral as well as the animal kingdom, it is a curious fact that silica deposited from fluoride of silicon, if crushed between plates of glass and examined microscopically, with a medium power, markings may be seen on the outer surfaces of the vesicles which resemble those of the diatoms, specially pleurosigma and coscinodiscus. It is also remarkable that Dr. James Blake collected fifty species of living diatoms from a hot spring in Pueblo Valley, Nevada, the temperature of which was 163° Fah. Flint probably originates from diatoms, as does also the silica in certain rocks.

The name *diatom* is derived from a Greek word signifying *being cut in two.* Diatoms resemble the desmids, but differ in having an outer skeleton, or frustule, of silica. The frustule of a diatom is a silicious box, always in two parts, one slipping over the other like a pill box or with edges apposed.

The thickness of a single diatom is, roughly, the sixth that of a human hair, and its weight is estimated at the 187-1,000,000th part of a grain. Some varieties attach themselves to other bodies, as the algæ, while others swim in the water free.

The study of the diatomaceæ, aside from their scientific interest, is very fascinating. Their extreme and varied beauty is a source of constant pleasure to the microscopist, and the question is often asked, Why is so much beauty veiled from human sight?

THE BEAUTY OF THE DIATOMS

consists in their color, their general form, and sculpture, or natural markings, which characterize nearly all of them. These delicate markings are seen under the microscope to be processes, knobs, bosses, concavities, ribs, groovings, and lines, so minute that the highest powers made by the most skillful opticians are required to see them at all; even then they can only be seen when the apparatus is manipulated by the most skillful operators. The lines of certain diatoms have been measured, and are used to test the magnifying and penetrating powers of object glasses. A slide called a test plate has been prepared on which twenty well known species are mounted, commencing with one on which the lines are comparatively coarse, and ending with one—*Amphipleura pellucida*—which has 130,000 lines to the linear inch. For the convenience of study typical diatoms are mounted on a single glass slide, so arranged that reference can be made to a printed catalogue for the names, while in some cases the names of the species are microphotographed on the slide.

The diatoms are placed on the plate by the aid of an ingenious device called a *mechanical finger,* by means of which the shells can be picked up singly and given the desired position. *Moller's Typenplatte No.* 1 has twenty-four lines in each of four groups, comprising about 500 individuals of 395 distinct species and 17 genera. The cost, with printed catalogue, is forty dollars.

Some microscopists are so fond of the study of these minute forms that they scarcely do any other work than to observe, collect, classify, and describe them.

When it is stated that the names of more than 4,000 distinct species of diatoms are given in a catalogue published by Frederic Habirshaw, of New York, each of which has some feature by which it may be distinguished, that this vast kingdom, so to speak, is invisible to the human eye, or nearly so, that when highly magnified many of the species are extremely beautiful, and all of them interesting, it is easy to understand why so much interest is taken in them the wide world over, and why every new discovery is heralded, and calls for samples come from the whole scientific world.

It is an established fact, strange as it may seem, that some of the greatest mountain chains, such as the Andes, and the very soil beneath our feet, are chiefly composed of the

REMAINS OF ANIMALCULES,

invisible to the eye; that is to say, the matter has been used by animated beings, and returned again to the mineral kingdom, retaining the form which it assumed while a part of their minute bodies. Byron has written with more truth than he probably realized that "The dust we tread upon was once alive," and the remark of Dr. Buckland is often quoted: "The remains of these minute animals have added more to the mass of minerals which compose the exterior crust of the globe than the bones of the elephants, hippopotami, and whales."

In the tertiary age beds of diatomaceous or infusorial earth were deposited, consisting almost wholly of these microscopic organisms. The extent of some of these deposits is almost incredible, and is regarded as an evidence of the great age of the world.

The Bohemian deposit in Europe is 14 feet thick, and, by the estimation of Ehrenberg, contains 40,000,000,000 diatoms to the cubic inch.

Darwin observed in Patagonia, along the coast for hundreds of miles in extent, a bed of tertiary sedimentary formation, 800 feet in thickness, overlaid by a stratum of diatomaceous earth. At Bilin, in Austria, a bed of infusorial earth, 14 feet thick, occurs. One merchant sells annually many hundred tons of it. The *Bergmehl,* or mountain meal, of Lapland and Norway, is from beds 30 feet in thickness. It must be remembered that these deposits extend over many thousands of square miles. Notwithstanding the astonishing fact that vast areas of the earth's surface are built of these minute forms, the true nature of these deposits was not known until 1837, when Ehrenberg published his celebrated work on that subject. The same deposition is taking place at the present time. In certain lakes in the United States and elsewhere, deposits several inches in thickness accumulate, composed wholly of the remains of recent diatoms. When thoroughly dried a chalky powder is obtained, which, under the microscope, is easily recognized. Similar deposits have been made known by dredging the bottom of the sea.

According to Professor Joseph Le Conte: In the deeper parts of Lake Tahoe, which sediments do not reach, the ooze is composed wholly of diatoms or infusorial shells.

Dusty showers of a grayish or red color are not unfrequent on the Atlantic and Indian oceans near the coast of Africa. Ehrenberg examined this dust and found it to consist largely of diatoms. He estimated the quantity let fall during a dust shower in the year 1846, near Lyons, at 720,000 pounds, one-eighth of which was diatomaceous, or 90,000 pounds, equal to 45 tons. Diatomaceous earth may be distinguished from other formations of a similar appearance by its insolubility in acids, extreme lightness, power of absorbing liquids, and property of polishing metals. It is instantly recognized under the microscope in the hands of one who is familiar with its use. Diatomaceous earth has its uses as well as its scientific interest. It is largely consumed as a polishing powder under the name of tripoli, from the locality which first gave it to commerce. It is known in California by the absurd name of *electro-silicon,* and at the East by a variety of trade names. It is a very convenient source of soluble silica, employed in the manufacture of silicate of soda or potash, also known as soluble glass. The manufacture of this compound is simplicity itself. Carbonate of soda or potash, as the case may be, is dissolved in boiling water to saturation, in a capacious iron kettle, and fresh hydrate of lime added until all the carbonic acid is precipitated, and the alkali becomes caustic. Diatomaceous earth in a powdered state is then added as long as silica is dissolved, and the whole covered and allowed to cool. When the insoluble matters have settled the clear liquid is drawn off and evaporated in a clean vessel to the required density.

Diatomaceous earth is also used in the manufacture of porcelain, and it is a constituent of certain cements and artificial stones. At one time it was claimed to be a fertilizer, but this is thought to be a fallacy, although Ehrenberg states that the fertilizing power of the Nile mud is furnished by fossil infusoria.

Slabs of diatomaceous earth absorb liquids with avidity, and are used in laboratories for drying crystals and filters. This property might be more generally utilized if better known.

A convenient contrivance for lighting fires is a lump of diatomaceous earth with a handle of stout iron wire. It is dipped into a vessel of petroleum, placed in the stove or fireplace, and lighted with a match. It continues to burn safely for some time. It can be used again and again. No person, however, should make use of it who has not the common sense to carefully set away the vessel containing the coal oil before lighting the match.

Bricks that float in water are made of diatomaceous earth mixed with one-twentieth part of clay and well burned. The art of making these floating bricks was well known in the time of Pliny, but was afterward lost. It has recently been discovered. In the Italian department of the Paris Exhibition of 1878, these bricks were exhibited, which attracted considerable attention. Floating bricks, made wholly of California material, may be seen in the State Museum.

Kieselghur, or "*flint froth,*" of the Germans, from a deposit in Hanover, is extensively used in the manufacture of dynamite, giant powder, lithofracteur, and other explosives. Diatomaceous earth absorbs from three to four times its weight of nitro-glycerine, with the advantage over other absorbents of retaining the nitro-glycerine under greater pressure. Dynamite contains 27 per cent and lithofracteur 23 per cent of diatomaceous earth.

Before the kieselghur can be used it is subjected to treatment to remove water, all organic matter, and coarse particles. It is first calcined in a succession of furnaces, crushed between rollers, and sifted.

It is claimed that the diatomaceous earths of California are unfit for this purpose, but it is the opinion of the writer that they have not had a fair trial.

Diatomaceous earth is largely used in the manufacture of soap to mechanically increase its detersive power. The Standard Company receive large quantities of it from the southern counties of the State.

### Imitation Ground Glass.

A very useful kind of varnish is made known by Léon Vidal, which is excellent for producing imitation of ground glass, and will doubtless be found available for other purposes. The formula is:

Sandarac, 18 parts; mastic, 4 parts; ether, 200 parts; benzol, 80 to 100 parts.

### Gelatine Emulsion-Making in Hot Weather.

I have thought it might not be amiss to describe the plan I have been following in making emulsion during the last hot weather we had. In my plate making room the temperature was often at 85°; but, nevertheless, several batches of plates were successfully prepared. The method adopted is very similar to that I described in my little book, "The Practical Working of the Gelatine Process;" but there are one or two alterations in procedure. In the first place I use the formula which was described in last *Journal,* using potassium bromide instead of ammonium. It is as follows: Potassium bromide, 250 grains; Nelson's No. 1 gelatine, 45 grains; water, 1 ounce; strong hydrochloric acid, 2 drops.

This is prepared in the usual way, and warmed up to 120° Fah., and the following added in the usual way: Silver nitrate, 300 grains; water, 3½ ounces.

Finally, this next solution is added: Potassium iodide, 12 grains; water, 1 drachm.

This I mix in a long hock bottle, shaking between each addition. This is transferred to a glass flask and boiled for half an hour, shaking up the emulsion at intervals. This is allowed to cool in the flask for half an hour, when to it is added, with shaking: Nelson's No. 1 gelatine, 120 grains; Coignet's gelatine (new brand), 120 grains; water, 3 ounces.

After soaking and very slightly heating to melt it, about three drops of strong ammonia in half a drachm of water is then stirred in, and the emulsion is poured out into a jam pot, which is immediately placed in iced water, a few lumps of ice floating in it. In half an hour the gelatine will be firmly set. The jam pot is then dipped for a few seconds into boiling water, which will loosen the gelatine from its sides, and the lump of emulsion is transferred into moist canvas, and squeezed through into a jar of iced water (the water having been run through filter paper to get rid of all floating matter), in which a few small lumps of washed ice are floating. After ten minutes the water is changed, and after another ten minutes is changed again, when it is again collected in the canvas and squeezed through into water. One more change of water should be sufficient to free it from all except traces of soluble salts. It is then transferred to the canvas and allowed to drain over a jar half an hour to three-quarters.

It is again transferred to the jam pot and melted, and a slight trace of carbolic acid (or other antiseptic) added, and then once more placed in iced water. In half an hour it is set, when it is covered with alcohol and allowed to ripen for a day; and if the jar be placed in water containing a lump of ice, so much the better. When plates have to be coated, the slab on which the plates have to be set is covered with small lumps of ice for half an hour, and if it be thick it is only very gradually cooled; but, on the other hand, it also only very gradually gets warmed again. During this time the emulsion is melted, six drachms of alcohol added, and filtered.

When the plates are coated (after the slab has been dried from all water) it will be found that the film of emulsion will set in a couple of minutes, and that the slab remains cool enough to enable five or six batches of plates, filling the slab, to be prepared; that is, supposing your slab to hold eight plates, you can coat forty to forty-eight without recooling the slab. I find that the gas of the drying box may be lighted immediately, and the drying of the plates will proceed rapidly and not remelt. If gelatine be once *well set* it requires a high temperature to remelt it; and the more water is evaporated the higher the temperature required. As the current of warmed air passes over the plates the moisture is rapidly absorbed, and hence the drying can be effected with safety.

My excuse for writing this must be the fact that I have had many letters asking how I prepare emulsion in this weather, and I trust that this description may be taken as an answer to them. Doubtless there are other modes which will succeed as well; but I think, for an amateur, this plan will be found to be everything that is required. I would just say, that, supposing by any chance the emulsion appears too thin before coating the plates, 40 grains of Coignet's gelatine may be melted in 3 drachms of water and added to the emulsion, with much stirring, immediately before filtering.—*W. de W. Abney, F.R.S., in Journal of the Photographic Society.*

### The Chilcat Meteor.

The State Mining of Bureau California has lately come into possession of the meteorite found among the Alaska Indians by Mr. John Muir. The meteor was seen to fall, it is said, by the father of one of the oldest Indians in Chilcat, over a hundred years ago, and was afterward sought out and carried to his hut in triumph. Through the co-operation of the Northwest Trading Company, the Mining Bureau succeeded in conducting negotiations for its purchase; and for a consideration which seems meager as Esau's mess of pottage in the eyes of scientists, the State of California acquired clear title to the meteor, and it arrived in the city, June 24. This aerolite is exceedingly irregular in shape, and the projecting points are as bright as if they had been burnished. A succession of nut-shaped hollows, which cover almost the entire surface, give it an exceedingly curious aspect, and its fantastic contour looks almost as if it had been moulded by some unknown power into the shape of the head of a strange beast. It weighs a hundred pounds or upward, and has been christened, in honor of the locality from which it was procured, "Chilcat Meteor."

### A Leech Farm.

In 1841 Mr. H. Witte established a small leech farm in Kent Avenue, Williamsburg, L. I. In course of time this small establishment was abandoned, and one of thirteen acres was established near Newtown, L. I., and to him the writer is indebted for the following information and description of the only leech farm in America. The breeding ponds consist of oblong squares of one and a half acres each. The bottoms of these ponds are of clay, the margins of peat. In June the leeches begin forming their cocoons on the peat margins of the pond.

The greatest enemies to the young leeches are musk rats, water rats, and water shrews, who dig the cocoons out of the soft peat breeding margins. Next to rats and shrews is overheating of the peat or the water of the pond. In fact, nothing is so fatal to leeches as a too high temperature. Mr. Witte tells the *Oil and Drug News* he has had leeches frozen in solid ice, but by slowly dissolving the ice and gradually increasing the temperature of the water the leeches sustained no injury. The depth of the water in the ponds during the summer is three feet; in winter time the depth of water is increased to avoid freezing.

The leeches are fed every six months on fresh blood placed in thin linen bags, which are suspended in the water. The leeches, as soon as they smell the blood, assemble from all parts of the pond, and attaching themselves to the outside of the bag, suck the dissolving coagulated blood through the linen. Digestion proceeds very slowly with the leech, during which time the blood remaining undigested in the stomach of the leech is in a fluid state, as if just taken in. The excremental deposits are of a grass-green color. The best substance for packing leeches in is the peat of their natural ponds made into a stiff mud. Water containing tannin, tannic acid, lime, salt, or brackish water, must be guarded against always; iron is not objectionable, but is an advantage in small quantities.

The demand for leeches in the last few years has somewhat fallen off in the Eastern and Southern States. The Western States and California are now the heaviest buyers. Mr. Witte's sales alone average a thousand a day. The number of leeches imported into the United States amounts to about thirty thousand yearly.

The custom of stripping and salting leeches, to cause them to disgorge after having been applied, has passed away, as many well established cases have occurred of infectious diseases having been communicated on the application of the same leech to a second party. A very popular error exists that a leech when applied takes only the bad blood (whatever that may be) and rejects the good; this is a mistake. With a leech blood is blood, be it the cold blood of a fish or the warm blood of a human being, no matter how diseased that human being may be. So long as blood is not tainted or putrid the leech will thrive on it. A friend of mine, who was the proprietor of a large leech-breeding establishment at the foot of the Hartz Mountains, when wishing to feed his leeches, was in the habit of hiring poor laborers, at six cents per day, to stand in the water for half an hour nearly up to their thighs, that the leeches might obtain a full gorging of human blood.

In the marshy lands of Roumania the wild leeches are captured by means of men entering the water and allowing the wild leeches to fasten on to their naked bodies. The leech fishers then strip them off after reaching the shore.

[If it is dangerous to apply the leeches a second time the druggists should beware of the Hartz leeches. And the question may be asked whether the blood feeding practiced at Newton may not also produce poisonous leeches.]

### Dangers of Sulphuric Acid.

A driver named Sellers lately lost his life at Leeds, England, by the upsetting of a wherry or cart loaded with sulphuric acid. A witness testified that the horse was going at a good pace, and the deceased was unable to pull up, and therefore the deceased turned into a lane, but a wheel coming into contact with a stone the wherry upset, and Sellers fell into the road with fifteen carboys of vitriol, many of them broken, on the top of and around him. When the witness got up he could see nothing of the driver, but, after some moments, discovered that he was lying under four broken carboys. He got assistance, and a quantity of water and milk was thrown over the deceased, whose clothing was being consumed and flesh eaten away by the liquid. He was taken up and carried in an insensible state to a farmhouse near. The skin and muscles of his left upper arm, near the shoulder, had been destroyed for some distance, laying bare the bone. The left foot and ankle were similarly destroyed, as were also several other parts of his body. Shock to the systen caused by the extensive destruction of tissue was the cause of death two hours after the accident.

The coroner, in addressing the jury, said the case seemed to be one of accidental death. It was dangerous for a man to ride on his wherry, as the deceased had done, with such a load behind him; but, of course, he would not expect any accident to happen. Seeing what had been the result of the accident, happening where it did, it was a matter for consideration as to what the consequences would be were such a terrible affair to occur in a crowded thoroughfare, passing through which these wherries of carboys were every day. He had seen the carboys packed in three tiers with only a rope put loosely round them, and should an accident happen the chemical might run down the causeway and produce frightful results to foot passengers. It was a question for the authorities of the town as to whether this mode of conveying vitriol was a proper one. The jury returned a verdict of "accidental death."

### The Prevention of Fouling in Iron Ships.

The prevention of fouling in the hulls of iron ships is a matter that has long engaged the attention of those interested in the construction and equipment of iron vessels. Many methods have been tried in order to protect vessels against the growth of barnacles in tropical waters, but it can scarcely be said that any of these have proved entirely successful. At present, ships require to be periodically docked and cleaned, and this entails not only a loss of time, but considerable expense. Much interest is, therefore, taken in a new ship which was launched from the shipbuilding yard of Messrs. T. B. Seath & Co., Rutherglen. This vessel, which is named the Bessie, is built from designs by Mr. G. L. Watson, naval architect, for Mr. John Clarke, Paisley, and is intended as a tender for the yacht Condor.

The novelty about the Bessie is that it is covered over the hull, to six inches above the water line, with a plate of zinc, and by means of this it is believed that the vessel will be thoroughly proof against fouling. The thickness of zinc employed is not great, and it is fitted so closely as not to interfere in the slightest with the delicate outlines of the vessel, but its thickness is sufficient to last, it is calculated, for fully six years. The patentees of this system are Mr. J. Jepson Atkinson, barrister, and Mr. C. F. Henwood, naval architect, of the Middle Temple, London.

The well known action of iron on zinc in salt water led to the discovery of this invention; but while the use of zinc was well known, the difficulty of attaching it to the hulls of ships remained. Mr. Atkinson and Mr. Henwood have completely overcome this difficulty, and there can be no doubt that the use of their system will be watched with much interest by the shipping community. The method employed in fixing the zinc is simple and effective. The zinc sheets are attached to the iron plating of the vessel at spots nine to twelve inches apart, and at these spots a mechanical joint is made by an alloy or solder, the surface of the spots being about an inch and a half square. The method of attachment causes the zinc to act like copper on the bottom of a wooden ship. Zinc in the ordinary seaway coming in contact with iron oxidizes to the extent of about two to three ounces per square foot in a year, but by attaching zinc of sufficient thickness the vessel can be kept at sea for several years without docking, cleaning, or painting. Scraping will not be required, and the speed of the ship will not be diminished by the growth of barnacles. Mr. H. N. Moseley, of the University of London, has expressed himself satisfied with the chemical action of the new process, and there can be no doubt that the invention will, if successful, be of immense importance to shipowners. The career of the vessel will consequently be watched with great interest.—*Marine Engineer.*

### Composite Portraits.

At the last meeting of the Photographic Society of Great Britain, Mr. Francis Galton, F.R.S., read a paper on "Composite Portraiture," in which he stated that his attention was first directed to the subject some years ago, when he found that by taking two or more portraits of different individuals under exactly the same conditions, and superimposing them, the features, if not absolutely dissimilar, blended together and formed an idealized portrait which could be well seen when the image was thrown upon a magic-lantern screen. The register he adopted, so that the features should be identically superimposed, was by drawing a horizontal line through the eyes, another parallel to this through the mouth, and a third perpendicular to and bisecting these horizontal lines through the nose. The point of bisection between the eyes was that which he was especially careful to maintain in the same position in each portrait. Mr. Galton's first method of producing composite portraits was by means of a copying camera, paper positives being used. He now, however, used transparencies, and he exhibited and described the apparatus which he had adopted for the purpose. One purpose for which he believed composite portraits would be valuable was that of producing a standard physiognomy of disease With this object he had taken the portraits of a number of consumptive persons, male and female, and had combined them; and it was remarkable how a certain average of faces was found to be almost identical. Mr. Galton also exhibited a number of what he called typical portraits. One was the face of an idealized criminal, formed from a combination of seven portraits of criminals, others were the faces of consumptive patients, and a third series was that of the portraits of officers and men of the Royal Engineers. In one case he had combined the portraits of twelve officers, in another the portraits of eleven privates, and in a third he had combined the portraits of officers and privates. In each instance Mr. Galton said the individualty marking each class was strongly brought out and idealized. He also pointed out how, in every case, the idealized portrait was better looking than the faces from which it was made.

In conclusion, Mr. Galton referred to the use which photographers might make of composite portraits. He thought the process could be turned to a most interesting account in the production of family likenesses. Artistic excellence was of no consequence in the negatives, and all that was necessary was that the portraits should be taken under the same aspect, either as a perfect profile or a perfect full face, and under the same conditions of light and shade. The result of the combination of a number of faces of the same family was often very curious, not the least singular point being the circumstance that there was often a difference of opinion as to whom the idealized portrait was most like. Mr. Warnerke said, that when Mr. Galton first described his method, some years ago, he had tried the production of composite portraits, and found the result exceedingly interesting. Captain Abney expressed surprise at the result of an experiment which Mr. Galton had made to show that repeated exposures on the same plate made no difference in the result. Had not Mr. Galton proved that he was right, he should have expected some difference. After a remark from Col. Wortley, Mr. Galton observed that one curious result he had noticed was in the case of a combination portrait of two criminal boys. This portrait was given to an artist to copy, and, singularly enough, although the artist had never seen either of the boys, the picture he drew was a portrait of one of them rather than a copy of the composite.

### RECENT INVENTIONS.

A table especially designed for convenience in writing on large heavy books, such as books of record that are used in registers' and other public offices, has been patented by Mr. John A. Harriman, of Bellaire, Mich.

An apparatus for preparing wheat for grinding has been patented by Mr. James Willard Smith, of New York city. The object of this invention is to remove the dust, fuzz, and other impurities from the creases in the kernels of the wheat, and also to prevent the bran from being pulverized and mixed with the flour.

An improved vehicle specially adapted to the use and amusement of children, which shall serve either as a wheeled carriage or as a swing, its construction insuring the comfort and safety of the occupant, has been patented by Mr. Mason Remley, of Hamden Junction, O.

An improved lye-trough for soap-makers, patented by Mr. Daniel F. Trout, of Feesburg, O., consists of a trough or pan made of metal or wood, with a spout at one side or end, which is on a level with the bottom of the trough or pan.

In most of the so-called "magic" pen and pencil cases the pen cannot be pushed out for use unless the pencil is also out; hence, in using the pen the pencil is apt to become inked and its point or lead thereby injured. Mr. Richard M. Collard, of New York city, has patented a pen and pencil case in which this defect is remedied, by so constructing the case that the pencil can be attached to or detached from the "magic movement" at the will of the user, so that the pencil-point will not be out while using the pen, though the case be drawn out to its full length.

An improved ice cream freezer has been patented by Mr. John Marsden, of Chester, Pa. The object of this invention is to furnish ice cream freezers so constructed that they will make smoother cream than the ordinary freezers, and will make a greater quantity of cream from the same quantity of material.

### A Phosphorus Microphone.

In his photophonic experiments, Professor James Blyth, of Edinburgh, was led to construct a useful form of selenium cell by dovetailing two brass combs, having alternate teeth knocked out, and filling up the spaces between the interlocking teeth with the selenium. A modification of this pattern is made by fastening a brass disk on wood, and sawing it across until it consists of radial sectors, which are afterwards connected by selenium. While trying to use amorphous phosphorus in place of the latter substance he found the phosphorus evolved a current which varied with the pressure on the phosphorus, and the idea occurred to him that a microphone could be made from it, which would not generate its own electricity. He therefore took a shallow wooden box having a brass bottom, and spread a layer of phosphorus upon it, a thin flexible brass lid covering the box and touching the phosphorus. Wires from a telephone were then connected to the metal top and bottom of the box, and on speaking into a mouthpiece directed to the thin brass cover, the words were distinctly reproduced. The varying pressure of the sound waves on the phosphorus established an undulating current, which, passing through the telephone, caused it to give out the original words. When a battery was included in the circuit the sounds were remarkably clear and loud and free from the grating which disturbs the carbon microphone. Professor Blyth also finds that the cell, which is really a form of loose contact, operates as a receiver as well as a transmitter, and will of itself emit articulate sounds under the influence of the vocal current.

### Silicon in Steel Rails.

Dr. Dudley's formula for the composition of steel rails allows 0·04 per cent of silicon, but other experiments show that ten times that amount of silicon can be admitted, and still retain an excellent physical character. The allowance of this margin is fortunate, because of the inability of determining when silicon is removed, as can be so exactly determined in the case of carbon.

Out of 35,000 rails on Swedish state railways, only 4 broke in the winter of 1880, under a composition of 0·20 to 0·30 carbon, and 0·1 to 0·3 silicon. The diverse views held by different experts, and various conclusions arrived at, show that much yet remains to be determined by experiment, before the best composition for a steel rail can be offered.—*North American Manufacturer, July* 14.

## Business and Personal.

*The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.*



## Notes & Queries

### HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) H. K. asks what is the velocity of steam through a six inch pipe open at the end, at a pressure of 20 lb., 60 lb., and 100 lb. A. 20 lb. above atmosphere, 1,413 feet velocity per second; 60 lb. above atmosphere, 1,447 feet velocity per second; 100 lb. above atmosphere, 1,464 feet velocity per second.

(2) E. G. asks at what age German carp, under favorable circumstances, spawn. A. Under favorable conditions, the second year.

(3) B. & P. ask for a receipt for making carmine ink, such as is used with rubber hand stamps. A. Dissolve a sufficient quantity of good fuchsine (aniline red) by trituration in warm glycerine. See inks, in SUPPLEMENT, No. 157.

(4) G. S. H. asks: What will remove smoke stains from ivory? I have a valuable set of chessmen which have passed though a fire and were smoked badly. A. Immerse the pieces in benzine, and go over them with a brush. We know of nothing that will dissolve the sooty matter.

(5) A. J. asks: Can the dark part of the moon be photographed? A. Mr. Janssen has succeeded in photographing the lumière cendrée, or "earthshine" on the moon when three days old. In the photograph the "continents" were to be distinguished clearly from the "seas." This disposes of the view sometimes advanced, and held by some eminent astronomers, that the "new moon in the arms of the old" was an optical illusion.

(6) E. M. asks: When and where was the first telegraph used in this country? A. The first telegraph line in this country was established on Long Island, by Harrison A. Dyar. The signals were made by frictional electricity. We can't give exact date.

(7) A. C. and others inquire how to etch on steel. A. The clean plate must be covered with an even film of wax, either applied while the plate is uniformly heated, or dissolved in alcohol and flowed on the warm plate. The etching fluid may be made as follows: Pyroligneous acid, 4 oz.; alcohol, 1 oz.; nitric acid, 1 oz., by measure. Or use iodine, 1 oz.; iron filings, half a drachm; water, 4 oz. The lines are cut through the wax with a fine steel point, so as to leave the metal surface bare under the lines. The etching fluid is then poured on, and removed as soon as the metal is sufficiently etched.

(8) L. T. asks for a simple process for extracting oils from herbs. A. The volatile oils are generally obtained by distilling in a deep narrow retort the articles along with an equal weight of water; but some substances that give out their oil with difficulty are first soaked for twenty-four hours in twice their weight of water, to each gallon of which 1 lb. of common salt has been added, by which its boiling point is raised, and consequently the oil comes over more readily. The distillate separates into two layers, the water being drawn off and returned to the retort, and this is repeated until distilled water ceases to come over mixed with oil. The rectification of the oil is performed without water, by the careful application of heat just sufficient to cause them to flow over pretty rapidly, so that they may be kept heated for as short a time as possible.

(9) H. R. asks how to make a strong paste that will not sour. A. Try the following: Four parts by weight of glue are allowed to soften in 15 parts of cold water for some hours, and then moderately heated till the solution becomes quite clear; 65 parts of boiling water are now added with stirring. In another vessel 30 parts of starch paste are stirred up with 20 parts of cold water, so that a thin milky fluid without lumps is obtained. Into this the boiling glue solution is poured, with constant stirring, and the whole is kept at the boiling temperature. After cooling, 10 drops of carbolic acid are added to the paste. The paste must be preserved in closed bottles to prevent evaporation of the water, and will in this way keep good for years.

(10) D. W. S. asks how to make and apply a good aquarium cement. A. A good cement is composed of 3 oz. of linseed oil, 4 oz. of tar, and 1 lb. of resin. These are allowed to melt together over a gentle fire. If too much oil is used, the cement will run down the angles of the aquarium; to obviate this, it should be tested before using by allowing a small quantity to cool under cold water, and if not found sufficiently firm, allowing to simmer longer, or have more tar and resin added. The cement should be poured in the angles of the aquarium while in a liquid state, but not when boiling, or it would most assuredly crack the glass. The cement will become firm in a few minutes, and the aquarium may then be tilted up in a different position while a second angle is treated likewise. This composition adheres firmly to the glass, is so pliant that it may be pressed into any shape by the fingers, and it does not communicate any poisonous quality to the water.

(11) W. M. M. writes: 1. I have some glass pickle jars of 12 fluid ounces capacity, inside measure 2¾ diameter by 3¾ deep. I have nine jars, and can get eight more same as these, and I want to make a battery for experimenting electric light, electroplating, etc., and I want to know the best way to fit them up, using carbon and zinc? A. For general experimental purposes a plunging battery is best; for continued use the bichromate battery with a porous cell is best; but your bottles would be too small to admit of the use of a porous cell. See SUPPLEMENTS, Nos. 157, 158, 159, for information in regard to batteries. 2. Is it best to put a zinc between two carbons, or a carbon between two zincs, or one carbon and one zinc, or is some other material better than carbon? A. Use two carbons and one zinc, placing the zinc between the carbons. 3. What solution is best: Smee solution of water and acid, or bichromate of potash? A. Use a bichromate solution and amalgamate the zincs. 4. If all the positives and all the negatives are connected, will it be the same, and give the same power, as if it was all one surface and in one cell? A. Yes. 5. Is it quantity or intensity that is needed to produce light and heat? A. For experiments with limited battery power the elements should be connected for intensity. 6. Can you give a description of a small powerful microphone—one that will repeat ordinary conversation carried on in a room about 30x10x12—and is it necessary to use an induction coil in the circuit of the microphone and receiver, and what kind of receiver can be used with it? A. Use the Blake transmitter and the Bell receiver. An induction coil is essential.

(12) C. H. B. asks how to prepare the mixture used in the storm glasses sold on the streets. A. The mixture is made as follows: Place in a long narrow bottle or test tube, camphor gum, 2½ drachms; spirits of wine, 11 drachms. When the camphor is dissolved add the following mixture: water, 9 drachms; saltpeter, 38 grains; sal ammoniac, 38 grains. Dissolve these salts in 9 drachms of water before mixing with the camphorated spirits, then shake the whole together. Cork up tight, and seal with wax, then make a small hole through the cork with a red hot needle, so as to have a small clean hole. Heavy atmosphere will cause the salts to rise; a light atmosphere, to fall. Cost of mixture, 10 or 15 cents.

[OFFICIAL.]

## INDEX OF INVENTIONS

FOR WHICH

**Letters Patent of the United States were Granted in the Week Ending**

**July 5, 1881,**

**AND EACH BEARING THAT DATE.**

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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